THE

ELECTRICAL REVIEW.

VOL. LXXVII. JULY 9, 1915. No. 1,963.

ELECTRICAL REVIEW.

Vol. LXXVII.] CONTENTS: July 9, 1915. [No. 1,963.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Trèves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

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THE SCIENTIFIC ORGANISATION OF SCIENCE.

WE have recently drawn attention to the imperative necessity of making use of all our resources to prosecute the war to a successful conclusion, and consequently the importance of utilising the intellectual reserves at our disposal; we urged the Government to take immediate steps to this end, and cordially welcomed the sympathetic attitude of the late President of the Board of Education towards the deputation of scientific men which he received shortly before he left office. Mr. Pease in the House of Commons outlined a scheme for carrying out the policy of enlisting the services of our scientists, and his successor declared his intention of putting it in force. All that was weeks ago—and yet no apparent progress has been made towards the fulfilment of the promises that were made, and in the meantime men are enlisting in the ranks who ought to be entrusted with leading posts in the scientific branches of our organisation, whilst others who cannot adopt that course are standing idle when they would gladly throw themselves heart and soul into the battle of the laboratory and workshop.

It is true that Mr. Lloyd George, in answer to a question in the House of Commons, recently stated that he was in communication with the War Office on the subject of employing scientific advice, and still more recently the Council of the Chemical Society, apparently despairing of Government action, has constituted itself a consultative body to consider and utilise suggestions that may be communicated to it by members of the Society, and others; and on Monday it was announced that Lord Fisher had been appointed chairman of a new "Inventions Board," to assist the Admiralty in co-ordinating and encouraging scientific effort in relation to the Navy. But these sporadic attempts to meet our urgent requirements are mere nibbles at the greater problem, and are entirely lacking in evidence of any definite and matured policy on the part of the nation. The formation of an Inventions Board—when it takes place, for the *personnel* is not yet organised, if, indeed, it has been chosen—is certainly commendable, but why should its operations be confined to naval matters? There is plenty to be done in connection with the Army, the aerial services, the commissariat, the medical service, and surely it would be preferable to co-ordinate all these branches by forming one advisory body with subdivisions, to avoid overlapping and waste of labour. That Lord Fisher, with his vast experience in naval engineering and architecture, will make an efficient chairman to the Board can hardly be doubted; yet we would have preferred to see a younger man appointed to this post, for the older a man is the more conservative are his tendencies, and it needs a young man with the gift of imagination in full vigour to grasp and visualise the possibilities of an apparently crude and impracticable idea. We saw this in the case of Mr. Marconi, for

example, who alone gathered together the threads which had been spun by his elders and, endowed with splendid imagination, wove them into the design which has become one of the landmarks of history.

As for Mr. George's movement, he spoke three weeks ago, and we have heard no more of the matter; and Mr. Henderson shows no sign of fulfilling his intention to carry out Mr. Pease's scheme. But not only inventions need consideration—there is abundant scope for scientific work in many other ways; methods which are in vogue may be faulty or detrimental and need correction; materials in use may be inferior to others that our scientists can indicate; substitutes may be required for substances that are scarce, new ways of preserving food and ministering to the comfort of our sailors and soldiers can be devised, and even the psychologist will find useful occupation for his knowledge in the trenches, and on board ship. We have the men, able and willing to devote their ability to the nation's service; why, in the name of all that is mysterious, do we not instantly avail ourselves of these invaluable resources, as the Germans have done from the beginning, and as our French and Belgian Allies have already done? Those who scan the pages of our French contemporaries will find that for the preparation of foods special processes and machines have been developed; similar attention has been given to the soldiers' clothing, and in many other ways advantage has been taken of the knowledge ready to hand, but in our case unutilised. Why do we wait?

We note that on June 19th, Mr. F. Creedy, a well-known electrical engineer, in the *Times* proposed that a voluntary organisation should be formed to do the work, in the absence of Government action; the Chemical Society has already taken steps in that direction, and on June 21st Prof. Armstrong called upon the Royal Society to organise itself for the service of the State or forfeit its claim to the peerage of science. All such efforts are laudable, but, as we have said, sporadic and unorganised—in fact, unscientific; what we want is the scientific organisation of science to aid us in the war, and we want it *now*.

The National Register.

The National Registration Bill passed its second reading in the House of Commons on Tuesday. The opposition, both numerically and in respect of forceful argument, was, like the alleged German air raid on Landguard Fort, "hardly worth notice." We need not waste space in condemning such obstructive and anti-national efforts—the nation may be trusted to recognise its friends. In our opinion national registration is one of the imperative necessities arising out of our present national emergency, and if it is inquisitorial it is no more so than the periodical census and the National Insurance Act. In place of the private inquisitorial attentions of ladies and others, it will afford every man and woman an opportunity for self-examination, and will enable them conscientiously, we hope, to decide whether they are or are not aiding their country in her hour of need. That will be something gained. Not less important, however, is it that at such a time the nation should have at command complete information, from which it may be possible accurately to judge the extent and character of our available resources. Further, it may enable us to avail ourselves with greater efficiency and facility of particular classes of labour, knowledge and experience, and to prevent further enlistment for the Forces of men who ought to be in the factory or the colliery, or keeping the trade wheels turning. Lord Kitchener is stated to hold that Mr. Long's Bill will enable him to avoid taking men who ought not to be taken. At present without such a Bill we are getting mechanics back from the training camp, and in some cases from the trenches, but the Registration Bill will give us organisation which will prevent future enlistment of men in the wrong armies. Mr. Long says that the Bill is essential if we are to organise the nation as it ought to be organised. It will enable us to effect the mobilisation of necessary forces with a measure of discrimination suited to our present needs. Mr. Long asserts that while supporting those splendid fellows who are fighting heroically on sea or on land, it is no less our duty to see that everything possible is done to support our agriculture and our trade generally, and certainly our export trade, which means so much to the income of the nation. With reference to these trade matters, he is constantly being asked: "Can you find me so many men? I can employ them if I can get them." Also: "Do you think I am justified in carrying on my own industry? I do not know that it can properly be described as connected with the war." When the machinery contemplated by this Bill has been got to work it will be possible more satisfactorily to answer such questions. Manufacturers and workers, too, will then be able to see their way more clearly than they can do now.

Electrical men do not need to be reminded of the completeness and efficiency of the German system of organisation—some of them have been surprised in peacetime at the method of some of the bigger companies who have pigeon-holed all the particulars they could secure of Britishers whom they considered "good men" technically or industrially, and likely at some time or other to be useful to them.

Events have proved that we have been sadly lacking in respect of national organisation in the past. We believe that the present Bill will be welcomed by the vast majority of the people because it enables us to do something tangible toward remedying that defect.

Electricity Outclassed.

To those who have burnt the midnight filament in attempts to provide ways and means for supplying the British workman with electricity for lighting purposes, and have, moreover, satisfied themselves that it can be done, we commend the following:—

In October last, the Finchley Council decided to adopt electricity for lighting the whole of the workmen's dwellings on an estate, and lately, in order to obtain some idea as to the cost of supply, tenders were invited for the installation work on the first 100 houses.

Of 29 tenders received the lowest, that of a local firm, was for £686 or £720, for w. or s.d. tubing, and in addition the electricity department's service charge would be £19. This is equivalent to from £7 to £7 10s. per house, entailing, for a 15 years' loan, annual repayments of about 13s. per house. So much for electricity: on the other side we have the local gas company offering to lay the connections and carcass all the first 100 houses *free of charge* in the event of the Council deciding to install gas there, but with the condition that if the Council supplies electricity to any of these dwellings within 5 years, it shall pay the gas company 10s. for each house so lighted.

Naturally, the responsible Committee decided in favour of gas, while our last information goes to show that the Council was "considering" the report in camera. Some thoughts will not bear publication.

The Lead Position.

The lead market has been very much under the influence of speculation, and the sharp reaction which followed the upward movement to £30 a ton for September deliveries about the middle of last month was succeeded by a substantial downward movement, which carried prices to about £24. The market has been undoubtedly controlled by mere specu-

lation, and in America at all events, determined efforts have been made to drive up prices in much the same way as that witnessed in connection with spelter. The manipulators, however, have a less easy task before them in attempting to deal in this way with lead than they had with spelter, for the entire basis of their manipulation of the latter metal rested upon the fact that Germany and Belgium between them were responsible for fully 50 per cent. of the world's production. This naturally laid bare almost unlimited possibilities for market manipulation, particularly in view of the fact that spelter would be required in enormous quantities for the production of war munitions. With lead, however, the position is vastly different, Germany and Belgium between them contributing less than one-fifth of the world's production. Great Britain can draw about 120,000 tons from Australia, if needs be, while the Spanish production exceeds 200,000 tons a year, and that of the United States will this year exceed half a million tons. These considerations must be taken into the clearest calculation when attempting to rig the lead market, but may not have much effect upon the Teutonic-American interests, backed with unlimited capital and engaged across the Atlantic in making things as hot as possible for the Entente Powers.

The suspicions entertained regarding the *bona fides* of the last big upward movement have proved themselves abundantly justified by the subsequent course of events. Considerable suspicions were aroused in high quarters by the persistence of the demand met with for lead in the open market, buying being of the most vigorous character, and orders being carried out with a freedom which gave rise to the belief that the price paid was really a secondary consideration. It is no wonder that, under these circumstances, suspicions should have been engendered in high quarters, and the announcement which was made at the close of last week that the Government had decided to prohibit all exports of lead, therefore created little surprise in some of the best informed quarters.

It must not be forgotten, however, that a complete embargo upon shipments from this country would inevitably prove a source of considerable embarrassment to our Allies, Russia and France, and it is inconceivable that this could form any part of the British policy at this juncture. It is probable, therefore, that no hindrances will be placed in the way of really legitimate dealings with the countries named, both of which are forced to supply a considerable portion of their needs from the London market, and it is regarded as pretty well assured, therefore, that under due safeguards shipments will be permitted.

At the present time, the London market stands well below the level of New York. The latter market has been greatly influenced by gambling operations, and it is probable, therefore, that the prices ruling across the Atlantic represent a sentimental rather than an intrinsic value. Any operation initiated with the intention of cornering the market would have in all probability to be started in America, since the export regulations on this side have dashed the hopes of the bull party. The greatly increased and still increasing output in North America is bound sooner or later to tell upon the situation, and there is plenty of lead in sight in Europe.

Electrical Imports during the War.

Elsewhere in this issue we give interesting tables showing the values of electrical imports into the United Kingdom since the outbreak of war. The figures for the corresponding months of the previous year are also given. Little comment is needed; the figures speak eloquently for themselves, and will enable the reader to see at a glance the changes that have been taking place. The most noteworthy feature is the big increase in our purchases of electrical requirements from the United States, whose total for the period is in the neighbourhood of that for the business previously done with Germany. The imports from Holland and Spain are quadrupled in value; those from Switzerland are more than doubled; while those from Italy and Canada also show very considerable rises.

OUR FUTURE.

Each succeeding month the unenviable record of our enemies grows worse, and the judgment of the civilised world in condemnation takes more definite shape until there seems to be not the slightest room for doubt as to what the ultimate issue *must* be if following generations are to be permitted to enjoy what we have latterly looked upon as the common heritage—the right to live in freedom. We may not be able to see very far ahead just now, but it is unthinkable that there can be permitted to remain any "Kultured" Force to dominate Europe; in the end the policy of frightfulness and terror must bring about its own undoing. It is that policy that has arrayed such a combination of nations in one common cause against the Central Empires, and apart altogether from the financial weakness that seems to be inevitable for those Empires for many years to come, there can be nothing short of dethronement of Emperors and Sultan and the absolute crushing of those who with them have in less than a year mangled the life of practically the whole of Europe beyond recognition. That we are a long way from securing that absolute victory which is essential, if such is to be the issue, we all recognise. The Forces which stand for Freedom are, however, now fully awake, and are daily strengthening their resources; we shall do well to ignore all talk of peace suggestions and consider anything in the nature of a sudden collapse of the enemy as quite out of the question. There can be no collapse on the side of the Allies—we have got to see the thing through or we are lost.

Assuming that in the foregoing we have correctly stated the position, what bearing has our observation upon the future of industry? We, of course, admit that we tread on very uncertain ground, and that there is little light to guide us; pages of speculative writing might be indulged in with the aid of a little imagination, but such an effort would be wasted. Yet there are some things which seem to stand out so clearly that we do well to take a note of them even at this early date. First, we must recognise that though enemy connections with the outer world are nearly all cut off, German manufacturing ability and German population, save for war depletions, remain. The financial fabric of the German Empire may collapse when defeat comes, with, as some predict, such a shock as the world has never before heard, and the people may be crippled. The nation's goodwill throughout most of the world may be gone. Her reputation for barbarism may render her an outcast among the nations of the earth. But she will still have intact many vast industrial works and organisations which, so far as we can tell at present, will have to be reckoned with. We sometimes positively assert that British money must not in future be employed to keep German factories going, and if we were able to secure that that determined war-time resolution should be carried into effect as a definite imperial policy throughout these islands and in our Colonies, we should be able to handle the business because we have a sufficient manufacturing capacity therefor. But, much as we may desire it, the indications are not as favourable as they might be that such a principle would be unanimously adhered to after a short time—even in the midst of this terrible war are there not dissentients?—and apart from that consideration, when we have put the sword into its sheath and have resumed operations more congenial than shell-making, and are making up the arrears that Treasury restrictions have rightly imposed upon us, shall we be able to tackle the business that will be offered us by our present Allies? It seems to us to come down to this: the world has and will have great need for electrical and engineering requirements. We cannot expect to meet these requirements from the British Isles as our manufacturing facilities and organisation stand at present. The Colonies want us to do so. Our Allies want us to do so. Are we prepared or preparing to undertake the task? Is it possible to do so to any particular extent under the prevailing conditions? These questions, and others akin to them, must occur to us as we stand at this moment faced with the unquestionable fact that Germany's industrial strength is immense, and her organisation both scientific and complete. Mr. Lloyd George's speeches about munitions and the needs of the Allies in respect thereof have

shown that the Government has now a full appreciation of the manufacturing resources of German engineering and allied works and industries. It is the whole force of these industries that is being hurled east, west, and south, against her enemies. This circumstance alone has revealed the manufacturing deficiency of these islands. We have magnificent works in many parts of the country doing splendid business all over the world, but some of our engineers have long been impressed with the huge works idea, and the vast scale on which some Continental and American electrical organisations have been conducted has produced advocates of the huge works policy for ourselves in order that we may manufacture at more competitive prices. We are trying to meet a large part of our Allies' war requirements as well as our own, to conduct an essential home and export business, and are putting down new works in various parts of the country. We are even making plans for utilising in some way every available piece of suitable factory accommodation in gas and electrical and other works in the metropolitan area. Scattered and extravagant operations, it is true, but seemingly necessary to help us to accumulate that vast reserve of shells, &c., that our fighting men must have.

Is it to be anticipated that when we come to settle down to manufacturing the electrical requirements of peace for ourselves and our friends, our capacity, even taking into account all the new factories that we are now equipping, will be sufficient, or so organised that we shall be able to meet those needs, and meet them at competitive prices? In all probability there will be no works deficiency in Germany and Austria, unless establishments there meet the same fate as has broken up those in Belgium and Northern France. As we have already stated, Belgium shrinks back aghast at the very thought that if nobody else can supply her needs, she may be driven into the arms of her worst enemies for re-establishing her industries and rebuilding her cities and towns. Russia, too, on sentimental grounds, will be equally averse to resuming the old trading relations. Italy, as criticisms recently received from that country go to prove, is fearful of German industrial domination, and her traders suggest that we had better drop altogether our talk about capturing German trade in Italy unless we are going to do something more than talk. Yet it will be the manufacturing capacity that will go far to settle these questions when markets reopen. We should like to see a statement showing the actual manufacturing capacity of the British electrical and engineering industries, prepared by reliable authorities, placed side by side with the probable requirements of all these lands of our Allies. No doubt manufacturers will feel that there is reason for satisfaction if they can be assured that the after-the-war business of the United Kingdom will be sufficient to fully and profitably occupy existing works accommodation. British and Colonial requirements alone, if they are on only the same scale as in pre-war days, will mean a greatly increased demand if all are executed here; India will continue to give us the great bulk of her electrical business, no doubt; there will be large neutral markets more or less open to us; and at home we shall have to make up arrears of work which will have accumulated owing to the Government embargo on issues of new capital. Where, then, shall we be placed in respect to the question of manufacturing capacity? For the time being America has an excellent opportunity, and is rightly availing herself of it to the full extent of her ability restricted as even that is by the manufacture of munitions of war. Probably the States, as well as Sweden and Switzerland, will continue for some years after the war to fill a more important *rôle* in supplying those who cannot be served from England and will not be served from Central Europe. But the fact will still remain that Germany's electrical and engineering manufacturing capacity and organisation will not be taken away so long as she has several scores of millions of population from which to draw the necessary workers. Germany and Austria have been losing millions of men by death and disablement; large numbers have been withdrawn from skilled trades such as our own. France has been losing heavily in the same way, though probably by nature of the country and her occupations the loss to engineering skilled labour has not been in anything like the same proportion to her total losses. In this country we have been losing on a much smaller scale because the bulk of our men are still in training, and our loss of engineering workers may be reduced somewhat by calling back those whom we need now for the manufacture of munitions, and whom we shall need in the days to come in connection with our industries. The ability to meet future requirements in all the markets in which we are interested must be affected in a considerable measure by this skilled labour question. But the killing off of skilled labour, assuming that Germany is suffering in this connection worse than any of those with whom she is at war, will not kill off her factories, their effective systems of organisation, their technical educational and other training facilities for the younger generation. Defeat may bring the financial crisis, which will hinder the immediate renewal of her world-wide commercial efforts, and in other ways, which one can only conjecture, her plans for meting out complete commercial defeat of her rivals may go wrong. But it would be unwise to pretend that the excess manufacturing ability, the existence of a vast industrial people, and the necessity for those people accepting very low wages, will not have to be reckoned with. Their opportunity will come just as soon as it is proved to the satisfaction of possible buyers in present enemy lands that friendly and neutral nations are unequal to meeting their needs at satisfactory prices. We may be assured that Germany will be prepared to go such lengths as never before in underselling her foreign competitors; she will resort to all sorts of devices in order to sell her goods so disguised that they shall be considered British—there is evidence of this already. Where then do we stand to-day as an electrical manufacturing people in regard to preparations for the future? Are we to rest contented with the truism that the state of trade after the war will be largely controlled by economic conditions? Can we make no plans—even on paper—for preparing for those days so that we may be able to stand up against the poisonous gases of German commercial machination backed up by industrial organisation and manufacturing efficiency? Russia is short of munitions—why? She was not in days before the war an engineering nation, and she depended too largely upon Germany for her requirements. England has been short of munitions—why? We may have the full answer in due course, but may now at least ask: Should we have had to go about London finding every spare piece of available factory accommodation if, instead of buying so much machinery and apparatus, &c., from Germany, and thereby strengthening her engineering ability, we had added to our own factories and met our own requirements?

The British nation is organising itself at last for securing victory in the war. Necessity has driven us to it, and we shall win, but at a later date and with a far greater loss of life than if our organisation had been different. What about the organisation of our electrical industry? We believe that it has improved in recent years, but have we no advisers who can tell us what should be in course of preparation in these days in the industry itself, in readiness for the time when Germany is freed from the pressure of the British Navy, and is able to export again? Or are we to be contented with just a little more British and Colonial preference for British manufactures and a few additional orders from our present Allies? It would go far to guide us in our discussions of German trade capturing if we could tell just what our capacity was, and what the world was likely to require from us. It is to be assumed that by increasing our capacity, and, perhaps, by certain processes of reorganisation, we could produce some lines competitively that we have not so produced recently. We have quoted in our pages at different times the remarkable output figures of the—to us—colossal electrical works of Berlin and of the States, and bigger works in this country might be justified if we were assured of the necessary skilled labour without extravagant demands for its compensation; but these are questions which have to be settled by manufacturers of broad view and financiers of wide knowledge and large resources. We trust that we have such men amongst us who are weighing up these important questions and their possible effect upon the future of British electrical industry. All of us desire that that industry in the days that are to come shall be free from the defects which have given rise to

so much controversy in the past. Unless we are prepared to take some measures appropriate to so great an occasion, can we expect that that desired state of things will follow through our receiving the crumbs that fall from the rich man's table, while Berlin again takes a large part of the loaf?

As we have referred above to the necessity for the guidance that comes from big men and from experienced experts we may be permitted to bring these notes to a conclusion by divulging a conversation that we had with a most estimable German gentleman of wide experience several years ago. Mr. J. Stöttner, who, we believe, built up the great business of the Electrical Co., Ltd., in these islands from the very smallest beginnings, and was responsible for the placing of millions of pounds' worth of contracts with the Allgemeine Electricitäts Gesellschaft, in Berlin, was discussing with us shortly before his death the position of the electrical industry in this country. That matter was just then, as it had periodically been, one of the main themes of conversation among electrical men in London and in industrial districts, and was being much written about in the Press. Mr. Stöttner was no longer the representative of the concern to which for years he had devoted himself heart and soul. He appeared to speak with all sincerity, and what he said carried conviction. He deprecated our scattered and entangled manufacturing operations; decried the habit of attempting to manufacture "everything electrical" in a comparatively small factory; advocated the closing or else the complete reorganisation of many of our small factories which he considered could not hope to manufacture competitively when they devoted themselves to scores and hundreds of more or less dissimilar productions; he would, by a process of arrangement between different firms or companies, concentrate the manufacture of particular lines of machinery or apparatus in specialised factories run on a large scale, in several selected districts—motors here, switchgear there, engines and turbines somewhere else, and so on. This, in brief, was the course advocated by Mr. Stöttner, who knew the reasons for German success in Germany, and for his own success as a competitor here. He positively affirmed that if Britain, as an electrical manufacturing country, was ever to stand up effectively against Germany there was no other way in which it was to be brought about. We give his views for what they are worth. They were confidential, and were those of a German—though a highly respected one amongst us—and we do not think that at this important juncture of our national history we do wrong in quoting them. Since that date we have witnessed the carrying out of the idea on a small scale in connection with some sections of the industry in England, and it has been our privilege to visit works whose owners have had reason for feeling gratified with the measure of success which had attended their efforts at more or less strict specialisation. At times the best concerted schemes "gang aft a-gley," and the many interests requiring reconciliation, and needing to be called upon to make sacrifices and effect compromises, make Mr. Stöttner's proposition one of great complexity and difficulty, but we do not consider that any time spent considering such questions can be wasted in view of the vast changes that lie ahead internationally.

We are not afraid of future German competition—far from it, but we should like to see British electrical industry availing itself of the present opportunity to the full.

The future is hidden; there may be surprises; we have a long way yet to go before we celebrate the defeat of the forces which have broken the heart of Europe. Our calculations may be upset, but we do well to make them.

Arranging Nails by Magnetism.—A machine for arranging nails parallel to one another has been described in the *Iron Age*. The nails are fed into a shaking hopper, in loads of about half a ton, which delivers them into a spout of which the two lateral walls form the poles of an electromagnet. The nails are thus brought into order with their length parallel to the magnetic field, and are pushed by a lever into a receiver, the same action cutting off the excitation of the magnet. The machine is driven by a motor of ½-H.P., which keeps the hopper in vibration. The magnet consumes only half a kilowatt-hour per day

SHEATHED-WIRE HEATING UNITS.*

By C. P. RANDOLPH.

The ordinary construction of heating units utilises a metal or alloy resister, with mica, glass enamel, porcelain, moulded compound, or air as electrical insulation. A large number of the so-called electrical insulators become fairly good conductors at the temperatures reached by heating units, so that the field of available materials is narrow.

The general equation expressing the variation of electrical resistivity with temperature is $\log R = a/\theta + b$, where R = electrical resistivity, θ = absolute temperature, and a and b are constants, depending on the material.

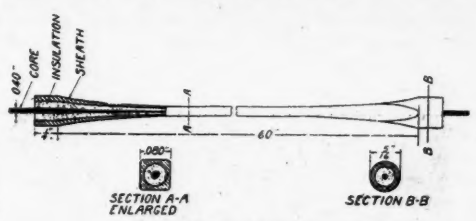


Fig. 1.—Sheathed Wire.

Such materials as mica, porcelain, the silicates, lime, magnesia, &c., follow this equation closely between 0° C. and 800° C.

The General Electric Co., U.S.A., has developed in the last few years an entirely new method of constructing electric heating units. Fig. 1 shows the construction and dimensions of a typical unit. The core, or electrical resister,

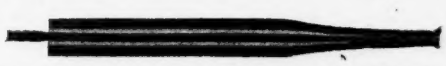


Fig. 2.—Cross-Section of Sheathed-Wire Terminal.

is made of a metal or alloy, chosen according to the resistivity desired. Air cannot penetrate the walls of the sheathing, so the ease of oxidation of the core is not important.

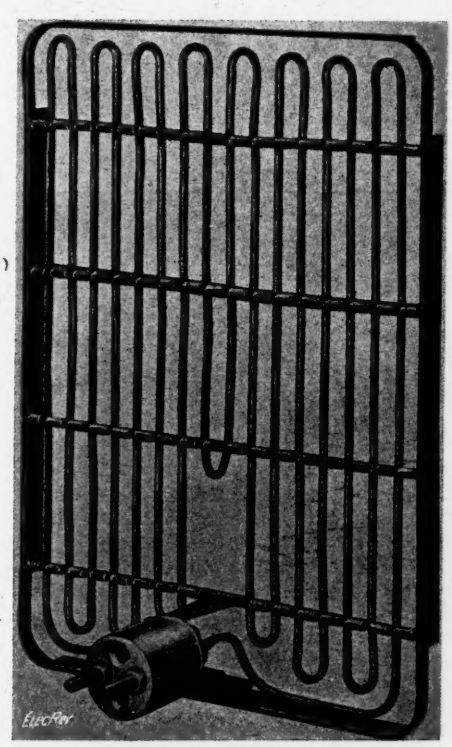


Fig. 3.—Open-Coil Sheathed-Wire Heating Unit.

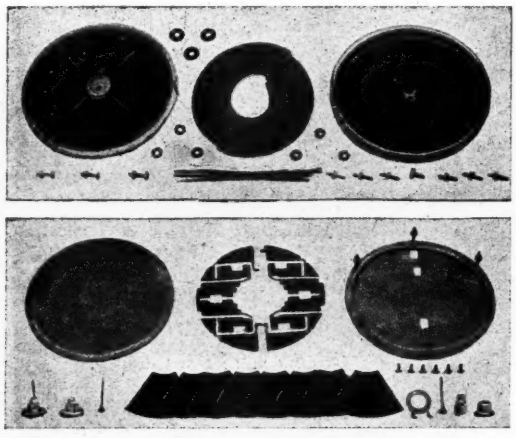
The operating temperature of the core may be 800° to 1,000° C. The insulation is a heat-resisting material, so

* From the *General Electric Review*

tightly packed that it is as hard as ordinary moulded compounds. The sheath may be steel, copper, or other metal or alloy, depending on the properties desired. The sheathed wire is enlarged at the ends or terminals so that the core is cool where it enters the air, although, as mentioned above, the temperature may be 1,000° C. over the small section. Fig. 2 is from a photograph of a section of a terminal. In the small cross-sections (see A A, fig. 1) the core may be 0 006 in. diameter, or larger. It is evident that the dimensions of the sheathed wire can be varied to suit the requirements of each heating unit. For example, a length of wire for a large boiler may have a terminal 1 in. outside diameter, the core where it enters the air may be $\frac{1}{8}$ in. diameter; the outside dimension on A A (fig. 1) may be $\frac{1}{4}$ in.; and the total length 15 ft. Or, a unit for a large japan or bake oven may have a terminal $\frac{5}{8}$ in. outside diameter, the core in the terminal may be $\frac{1}{16}$ in. diameter, the outside dimension on A A $\frac{3}{32}$ in. and the length 25 ft., and so on.

Fig. 4.—Section of Cast-In Hot-Plate, Showing Sheathed Wire Embedded in the Casting.

The piece of sheathed wire is formed into any required shape. Fig. 3 shows an "open coil" unit. In this type the coils are directly exposed to the air, and this is the correct design for heating ovens, &c., where it is important that most of the heat be transmitted from the unit by convection or air circulation. When the operating temperature of the steel sheath is above 400° C., the unit and frame are "calorised"* to prevent oxidation. Except at the terminals there are no porcelains, mica pieces, or other insulators to be easily broken, as the sheathed wire can be



Figs. 5 and 6.—Parts of Early Types of Hot-Plate.

supported directly on metal. The construction is just as rugged and simple as though the electrical resister did not have to be insulated.

Fig. 4 shows in cross-section another method of applying the sheathed wire in heating unit construction. A hot-plate is made by pouring molten cast-iron directly around a coil of sheathed wire. As a result, we have a hot-plate which is as strong and rugged as the old-time stove-lid; in fact, it is even more rugged, as the casting is reinforced with the wire; it does not warp or crack.

Figs. 5 and 6 show the number of parts used in constructing early types of 8½-in. diameter hot-plates. Compare these with fig. 7, showing a cast-in hot-plate.

The advantages of sheathed-wire heating units over other constructions may be summarised as follows:—(1) No fragile porcelain or mica is required to insulate the hot resister from ground. This allows a simple, rugged construction with minimum number of parts. (2) The open-coil unit is insulated and the operator cannot get a shock. (3) The resister cannot be displaced and thus grounded,

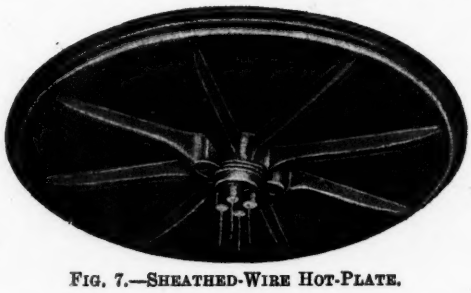


Fig. 7.—Sheathed-Wire Hot-Plate.

&c. (4) The core temperature is definite, depending only on the thermal resistance of the electrical insulation in the wire and on the temperature of the sheath. Therefore the design of sheathed-wire heating units is based on scientific calculations. This is not possible with other types of units.

* This process consists in forming a coating of aluminium steel alloy on the surface of the sheath.

NEW RUSSIAN CUSTOMS TARIFF.

(*Continued from page* 6.)

Poud = 40 funts = 36 lb.

* Imported by sea. † Imported over European land frontier.

	Old rate. Roubles.	New rate. Roubles.
Manufactures of copper, of copper alloys, or of other metals or metal alloys:—		
2. Articles not ornamented in relief, nor engraved, and stamped articles, even though in combination with wood, iron, tin-plate, leather, or other common materials:—	Per poud.	Per poud.
(*a*) Weighing over 6 funts each ...	8·00	9·90* 11·88†
(*b*) Weighing 5 funts or less each	9·00	15·07* 18·08⅘†
3. Articles ornamented in relief or engraved (except stamped articles), finished or unfinished, and whether put together or in parts; also ornaments, caryatides, medallions, busts, statues	21·00	27·83* 33·39⅘†
4. The articles enumerated in subdivisions (2) and (3) of the present No.; also articles, not specially mentioned, of non-precious metal — when gilt, silvered, or in combination with other costly materials, except the articles which fall under fancy and toilet articles.		
(*a*) Weighing more than 1 funt each; also (irrespective of weight) gilt or silvered metal in sheets or wire (except those falling under No. 148), or in the form of powder	Per funt. 1·10	Per funt. 1·21* 1·45⅕†
(*b*) Weighing 1 funt each or less ...	2·20	2·42* 2·90⅘†

Note.—In determining the duty on articles imported in separate parts (*i.e.*, taken to pieces) the duty is calculated according to the weight of each of the parts taken separately.

Wire:—		
1. Of iron or steel:—		
(*a*) Of a width or diameter of from 6¼ mm. down to 1 mm. inclusive	Per poud. 1·80	Per poud. 1·98* 2·37⅘†
(*b*) Less than 1 mm. down to 0·5 mm. inclusive in thickness ...	2·30	2·53* 3·03⅘†
(*c*) Less than 0·5 mm. down to 0·3 mm. in thickness inclusive ...	3·30	3·63* 4·35⅘†
(*d*) Less than 0·3 mm. in thickness	4·70	5·17* 6·20⅘†
2. Of copper or copper alloys or of any of the metals or metal alloys specified in No. 143:—		

	Old rate. Roubles. Per poud.	New rate. Roubles. Per poud.
(*a*) Of a width or diameter from 12·5 mm. down to 0·5 mm., inclusive	7·35	8·08½* / 9·70½†
(*b*) Less than 0·5 mm. down to 0·2 mm. inclusive	10·35	11·38½* / 13 66½†
(*c*) Less than 0·2 mm. in thickness...	11·85	13·03½* / 15·64½†

NOTE.—All wire coated with tin, zinc or other common metal pays 50 per cent. additional to the duty for which it is liable, according to the category under which it falls in the classification adopted in the present No.

Wire manufactures :—

1. Of iron and steel :—		
(*a*) Of all kinds, not specially mentioned	6·00	6·60* / 7·92†
(*c*) Iron and steel wire (even though coated with tin or zinc) covered with textile materials or gutta-percha, wire cables and hawsers of iron or steel :—		
(*a*) Not containing wire of less than 1 mm. in thickness	5·60	6·16* / 7·39½†
(*β*) Containing wire of less than 1 mm. in thickness	7·00	7·70* / 9·24†
2. Of copper, of copper alloys, or of similar metals or metal alloys :—		
(*a*) Of all kinds not specially mentioned	11·25	12·37½* / 14·85†
(*b*) Wire tissues prepared from wire having a diameter of :—		
(*a*) From 1 down to 0·2 mm. inclusive	16·20	17·82* / 21·38⅔†
(*β*) Of a diameter of less than 0·2 mm.	17·70	19·47* / 23·36⅔†
(*c*) Wire (even in the form of a bunch or cable) covered with textile materials, gutta-percha, caoutchouc, or other common materials, the diameter of the separate wires being :—		
(*a*) 0·2 mm. or more...	16·20	17·82* / 21·38⅔†
(*β*) Less than 0·2 mm.	17·70	19·47* / 23 36⅔†

NOTE.—Metal wire of all kinds, and also all manufactures of metal wire, covered with silk, whether such silk be mixed with other textile substances or not, pay the respective duties specified in the present number increased by 50 per cent.

	Per poud.	Per poud.
3. Electrical cables of all kinds ...	6·70	7·37* / 8·84⅔†

NOTE.—Under the old tariff metals and metal manufactures mentioned paid duty under these numbers, even if they were coated by any process (by galvanising, by the application of a layer of molten metal, by passing between rollers or in any other way) with common metals; provided that the superimposed coating did not exceed 25 per cent. of the total weight in the case of the metals and metal manufactures mentioned. In cases where the superimposed coating of metal exceeded the limit of 25 per cent., the metals and manufactures enumerated paid the duties or surtaxes fixed by the tariff for the superimposed metals.

(To be continued.)

WAR ITEMS.

British Insulated and Helsby Cables, Ltd.—An announcement has been issued by the secretary (Mr. S. Kerfoot) that the company is about to invest a large sum in the War Loan, but at present the directors do not propose to divulge the amount. At the present time the company is busily engaged on manufacturing power feeder cable, and some orders have been transferred to the United States. In view of the shortage of male labour due to the large number of men enlisting from the works, the company is, as far as practicable, introducing female labour, and numbers of girls are being trained systematically for work on light machines. A new building which has recently been erected has been set apart for female labour, and light machines for the main works installed there. Although skilled workmen are difficult to obtain, a system of day and night shifts has been established with very satisfactory results.

Openings in Italy.—We have received from the British Chamber of Commerce in Italy lists Nos. 20 and 21 of openings for British articles in Italian markets, from which we extract the following. Many of the firms inquiring formerly did business with German and Austrian houses and now seek British connections:—

No. 836.—Agent at Campobasso requires agencies for sundries for electric light installations.—C.L.A.

No. 845.—Firm at Rome wish to represent manufacturer of industrial machinery, tools, ironmongery, brass-ware.—F.

No. 874.—Engineer at Rome wishes to represent British firm supplying electro-mechanical machinery.—R.A.P.

No. 880.—Firm at Turin seek agencies for sundries for motors cars, electric lamps and material.—T.B.B.

No. 885.—Engineers at Genoa wish to take up, on commission, agencies for electrical material, and especially for steamers.—G.O.B.

No. 894.—Old-established firm at Genoa wish to take up agencies for oil, gas, and benzine motors, lubricants, oils, machine tools, machinery.—G.R.T.

No. 908.—Engineer at Rome seeks agencies for Italy for electric machinery and machine tools.—R.A.R.

Petrograd Electricity Works.—Having come to a decision on the purchase of the concessions of the electric lighting enterprises, the Petrograd authorities are inquiring into the methods of lighting adopted in other towns. With this object in view, inquiries have been addressed to all the large towns of America, Europe, and Australia. The Petrograd Council is desirous of profiting by the experience of other towns for the purpose of improving both its electric and gas lighting systems.

OUR ELECTRICAL IMPORTS DURING THE WAR PERIOD.

1913-4.

From	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	May.	Totals.
Russia, etc. ...	£12,034	£16,019	£14,199	£13,404	£27,156	£18,943	£22,783	£16,021	£12,609	£21,992	£175,160
Germany ...	122,562	133,908	148,409	134,883	146,858	133,110	159,634	181,521	159,821	167,730	1,488,436
Holland ...	1,123	2,328	2,322	6,218	2,799	1,742	1,211	4,475	1,170	1,089	24,477
Belgium ...	20,685	20,394	15,232	13,185	26,968	15,732	15,671	21,028	12,002	15,476	176,373
France ...	7,963	11,849	21,095	13,122	12,857	12,790	17,608	12,322	11,196	12,172	132,974
Switzerland ...	3,379	3,669	6,596	5,111	9,686	6,440	4,296	7,892	2,394	6,542	56,005
Italy ...	3,201	4,591	3,771	13,862	7,015	4,934	4,367	5,538	7,362	4,306	58,947
Austria ...	2,029	1,848	2,548	3,383	1,956	1,121	1,518	1,761	1,437	1,636	19,237
Spain ...	550	99	442	415	566	686	662	788	410	144	4,762
U.S.A. ...	42,595	57,885	51,242	54,954	58,433	62,462	42,944	40,797	64,521	59,564	535,397
Canada, etc. ...	180	151	360	400	550	215	250	416	283	227	3,032
Total ...	£216,301	£252,741	£266,216	£258,937	£294,844	£258,175	£270,944	£292,559	£273,205	£290,878	£2,674,800

1914-5.

From	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	May.	Totals.
Russia, etc. ...	£4,337	£7,429	£11,075	£20,237	£9,532	£11,946	£6,932	£16,881	£5,490	£13,382	£107,241
Germany ...	24,953	—	—	—	—	—	—	—	—	—	24,953
Holland ...	7,736	9,424	12,342	8,704	8,964	8,605	18,137	13,438	7,570	6,912	101,832
Belgium ...	3,755	18,700	4,398	495	10	88	—	—	—	—	27,446
France ...	3,208	3,250	8,320	10,845	6,974	5,363	6,850	9,423	10,368	13,720	78,321
Switzerland ...	1,080	3,574	9,542	7,064	13,016	7,503	6,479	23,787	9,274	36,539	117,808
Italy ...	1,624	4,102	5,036	2,922	36,808	4,738	2,483	9,072	9,874	10,053	86,712
Austria ...	665	—	—	—	—	—	—	—	—	—	665
Spain ...	52	1,213	684	2,180	2,264	1,995	4,351	867	3,584	3,850	21,040
U.S.A. ...	39,426	63,441	116,482	148,757	163,867	198,596	171,696	129,381	184,202	184,319	1,400,167
Canada, etc. ...	245	41	552	365	19,868	293	582	910	390	63	23,309
Total ...	£87,031	£111,174	£168,431	£201,569	£261,303	£239,127	£217,510	£203,759	£230,752	£268,838	£1,989,494

Electricity Workers and War Badges.—In the House of Commons on Friday, Mr. Touche asked the Under-Secretary of State for War whether he was aware that the manager of the Heston and Isleworth Electricity Works, in response to an application for war badges for certain skilled employés on his staff, made on June 4th, and containing names of firms engaged on Government work to which power was being supplied by his works, was informed that the issue of official badges could not be authorised on the ground that no power was being supplied to any factory manufacturing munitions of war; that his application was made as the result of a communication from the War Office to the Secretary of the Associated Municipal Electrical Engineers (Greater London), of which association he was a member, in which it was stated that a system had been instituted by which badges for skilled employés of suitable age, and willing to enlist if called upon to do so, could be obtained on application to the War Office; and that the application of this system was suggested by the military authorities to the Associated Municipal Electrical Engineers (Greater London) as a means of retaining their skilled employés? Was he aware that the attitude of the War Office towards applications for badges did not seem in accord with the official statement to the effect that several electrical companies had been offered such badges for issue to men of recruitable age who would be willing to enlist in the event of an emergenc would he say why there was an inequality of treatment in regard to the issue of badges to skilled employés of electrical services; and, if it represented a change of attitude, would he consider the advisability of its modification, with a view to granting badges to skilled emplovés of the Heston and Isleworth Electricity Works and to the employés of other companies similarly situated?—Mr. H. W. Forster: There has, as yet, been no change in the procedure as regards the issue of badges to employés at electricity power stations. The position is as stated in the first part of the question of the hon. member, but the power stations must be supplying power for the manufacture of munitions of war.

Another question was asked in the House of Commons on Monday. Mr. Touche asked why the issue of war badges to employés at electric power stations was limited to stations supplying power for the manufacture of munitions of war, and was refused to other power stations, although many of them were supplying power to private firms engaged on Government work and, even when not doing so, had been asked by the military authorities to prevent skilled employés from enlisting, and so to preserve the efficiency of electric services? Was it now desired to preserve efficiency only in cases where the stations supplied power for the manufacture of munitions, or was it the wish of the Government to have all power stations sufficiently manned? Why did the military authorities ask them to retain their skilled men, while refusing to issue badges to make it easier for them to do so, even where the men were willing to give an undertaking to enlist if called upon? Was any change in this procedure contemplated?—Mr. Forster, in reply, said he had nothing to add to the answer which he gave last week, except that under the new Munitions of War Act the making of regulations with regard to the issue of war badges to persons engaged on munitions or other war work had now been transferred to the Ministry of Munitions.

Scottish Electrical Contractors and Munitions.—In the course of a circular on munitions of war, issued by the Edinburgh Branch of the Electrical Contractors' Association of Scotland to their employés, it is explained that, at a meeting of the Association it was unanimously agreed to endeavour to get representation on the Committee which will be entrusted with the duty of carrying out the Government scheme in connection with munitions of war for Edinburgh district. "If acceptable," the circular proceeds, "we propose to offer to divide our own personal time between the conduct of our own business and any assistance we can give in furthering this work. Personally, we would like to have an expression of opinion from each individual employé in our employment if he would be agreeable to assist in this duty to our country. As a first proposal, we would suggest that, say, twelve hours a day be a working day, half of which would be given to our own work and half to munitions of war; some spare time on Saturday and Sunday could also be devoted to this work." In the event of the employé being willing to offer assistance through the firm he is asked to return a slip, which is annexed, duly signed, so that the Association can bring the matter before the proper authorities. There is, of course, nothing binding in this meantime. The slip is in the following terms:—"I am willing to co-operate in such scheme of work as may be arranged for the electrical trade." The idea is that, if the authorities approve, the masters and men in the electrical trade may put in six hours' work per day at munitions in three or four different shifts at a central workshop in Edinburgh. It is also thought to be desirable that arrangements should be made to furnish those who are willing to do munition work with work in the city, and so prevent them going to other centres.

Restricted Lighting Prosecution.—The "Times" reports that on July 2nd, at the Thames Police Court, Ernest A. Millbank, butcher, Commercial Road, E., was fined £20 for having a brilliant light in his shop, contrary to the provisions of the Lighting Order. It was stated that on the night of June 10th the defendant had a powerful electric light just inside his shop, which threw a sheet of light on the footway and a beam right across the roadway. In the shop were four other electric lights of the same power.

Munition Volunteers.—It is announced that the total number of war munition volunteers enrolled up to and including Sunday last was 67,650, and it is anticipated that, as only skilled men in employment in certain occupations were to be accepted, the great bulk of these will prove efficient. Mr. Lloyd George says that a certain proportion of them cannot be moved from their present occupations without detriment to the national interest.

The Eastern Telegraph Co. and the War Loan.—It is reported that the Eastern Telegraph Co., entirely without charge, cabled the text of the War Loan terms throughout the world, and the result should be to secure a large volume of support. To have sent such a message privately would have cost an enormous sum of money. The company's action was entirely voluntary.

After the War Trade Policy.—Mr. Asquith stated in the House of Commons on Monday that he was not yet in a position to make any statement concerning the appointment of a committee to consider the question of promoting and safeguarding British trade in other countries after the war.

LEGAL.

OSRAM LAMP LITIGATION.

(*Continued from page* 32.)

DR. PASSMORE was further cross-examined by MR. TERRELL.—The defendants' filaments are made by grinding together metallic tungsten and what has been called a binding material?—Yes.

You say that the binding material when it is destroyed by heat leaves a substantial quantity of carbon in the form of coke?—Yes.

What is left behind is coke with the metal mixed up with it and held together by it?—Yes.

That is the plaintiffs' case?—Yes.

And you say we get it held together in both the plaintiffs' process and our process by means of occluding it in a mass of coke. Is that right?—Yes, wrapped up, as it were.

Our case is that the quantity of what has been called binding material that we use is so small that the residue of coke is not sufficient to bind the particles together. Do you appreciate that? Yes.

You deny it?—Yes.

The plaintiffs' specification says that to get rid of the carbon, and at the same time not to convert your metal into oxide, you use a mixture of steam and hydrogen?—Yes.

You admit that the hydrogen defendants use is free from vapour at the time they use it?—Yes, when it comes in at the top, before it reaches the filament.

The case for the plaintiffs is: This hydrogen, although it is perfectly dry when it comes in, forms water vapour, and the water vapour acts in the way of the plaintiffs' specification?—Yes.

Now let me put defendants' case. Defendants say: We have got in our filament not free carbon, but carbide of tungsten, at the stage in which it is going to be submitted to the current of hydrogen?—Yes.

They say we have also got oxide of tungsten?—Yes.

And they say: What happens is this: when the carbide of tungsten is made red-hot in contact with the oxide of tungsten, the reaction that takes place is that the carbon of the carbide combines with the oxygen of the oxide and produces carbonic acid, or carbonic oxide?—Yes.

Carbonic acid, or carbonic oxide, is the result of both what the plaintiffs say happens and what the defendants say happens?—Yes.

But plaintiffs' case is the formation of a vapour first and the vapour acting upon the carbon that way?—Yes.

Defendants' case is no formation of vapour, but the carbon acting upon the oxide directly and forming carbonic oxide?—Yes.

Of course there are other larger issues as to whether, even if you are right on that, we are within the specification, but on the point we are now fighting that is the difference?—Yes, I understand.

There is another process in which we use a vacuum instead of hydrogen?—Yes.

We say in that vacuum the carbon of the carbide of tungsten or carbon, as it may be, combines direct with the oxide of tungsten and forms carbonic oxide or carbonic acid?—Yes.

You say No, there is this binding material which starts being destructively distilled?—Yes.

You say there is moisture given off, and that the moisture acts upon the carbon exactly as it did in the other case that I put to you?—Yes, but I do not say that the whole of the moisture comes from the destructive distillation. It is present in the tube. It probably comes from the wall of the tube. The tube is full of air which is laden with moisture. You pump the greater part of that air out and you pump the greater part of the moisture out, but you still leave some in.

But experimentally you do not prove that?—No.

Then what we are fighting about at present is: (1) What is the real reaction that takes place in both the hydrogen-flowing furnace and the vacuum furnace; and (2) if there is any water vapour, where does it come from, and what does it do?—Yes.

MR. WALTER: Do I understand that you suggest further that your binding material does not leave any carbon?

MR. TERRELL: No, I have not said that. All I have said is that there is carbon, but it is in the form of carbide formed in the first furnace.

DR. PASSMORE (proceeding) said the invention in Just and Hanaman's German specification 154,262 was the same as that which was in the struck-out part of the plaintiffs' specification.

It is a process for getting the carbon out chemically?—Yes.

And whatever carbon is removed, that carbon is removed by being converted into carbonic acid or carbonic oxide or both?—I have never examined which it is, but carbonic oxide is what is given in the reaction.

Just and Hanaman says: The reaction that takes places in my specification is that the carbon takes the oxygen direct from the tungsten compound?—Yes.

Now come back to the plaintiffs' specification. There an equation is given for removing residuary carbon by presenting it to an atmosphere of tungsten oxychloride, which provides the oxygen?—Yes.

And the carbon is removed by that oxygen in the form of carbonic oxide without first forming water vapour?—Yes.

Proceeding, Counsel dealt with Bottome's specification, and suggested that the patentee described a process by which he got carbon and metallic tungsten mixed together very intimately, which Bottome said was to be treated with steam and hydrogen.

Witness admitted that the steam would remove the carbon, or some of it, and that the hydrogen acted as a protective atmosphere to the tungsten.

The result is a metallic tungsten filament?—Bottome tells you the result is a carbon filament strengthened with tungsten. He had no idea that all the carbon should be removed, apparently.

Except that the result of Bottome is a filament which is partly composed of carbon and partly composed of tungsten, is there any difference in the process used by Bottome and the process used by the plaintiffs' specification as regards decarbonisation?—You start off with cotton fibres, but apart from that, no.

Then so far as the action of steam upon the carbon in the presence of tungsten goes, it being preserved by an atmosphere of hydrogen, it is the same?—Yes.

Lodyguine gives you all the reasons why a metal filament is a desirable thing to get?—Yes.

And if it required invention to distinguish the metals that will form a filament from those that will not, he has done it, has he not?—He makes a statement there which I do not accept as correct.

You have told me when I have been dealing with prior specifications that they did not give you enough information?—In the specification sued upon there is enough information for any man to make a filament with.

But I suggest to you that there is plenty of information in plaintiffs' specification by which a man would not make a filament at all?—Not as used by a practical man, I think.

In the "Z" case it was contended by the plaintiffs that the hydrogen was moist when it was used?—So it was:

And the Judge found that it was?—Yes.

SIR JAS. DEWAR, F.R.S., also gave evidence. He said he had nothing to add to Dr. Passmore's description of the defendants' process.

Having seen the process and having carried out experiments on that process afterwards, will you tell my Lord, pursued MR. COLEFAX, whether or not carbon is removed chemically?—Certainly.

In what form is the carbon removed, that is to say, what is the chemical compound or compounds of carbon found as it is removed?—The only chemical compounds could be some oxidised form of carbon.

I understand it is suggested that in the defendants' process, in the first stage of heating to 950° C., the carbon enters into combination with the tungsten, and I think it is suggested to form carbide of tungsten. Would such a formation of carbide of tungsten be in accord with what is known with reference to the nature of carbide of tungsten?—Certainly not. I was well acquainted with Prof. Moissan, who was the first to produce carbide of tungsten, but that was produced in the electric furnace, the temperature being at 2,000°. There he got a definite molecule, composed of two atoms of tungsten and one of carbon, but any form of so-called tungsten containing carbon was always produced at the highest temperature of the furnace where the tungstic oxide was reduced directly with carbon or coke.

So far as chemical knowledge and literature goes, I take it you know of no justification for the suggestion that at a temperature of 950° C., any carbide of tungsten is formed by the interaction of carbon and tungsten or carbide and tungsten?—It is quite impossible. From knowledge of tungsten compounds, I say all these carbides that have been revealed are high-temperature electric-furnace products.

DR. OTTO OBERLANDER said in evidence that he had been practising in England as a consulting chemist since 1906. He was approached by Mr. Hirst, chairman of the General Electric Co., who were now sole selling agents under the Just & Hanaman patent, with a view to making inquiries to enable them to make filaments similar to the filaments known in the Osram lamps. At that time the General Electric Co. had no interest in the Just and Hanaman specification. In 1907 he put the Just & Hanaman specification into practice, and made filaments from it. It was not necessary to submit them to any equalising process, because they were sufficiently uniform when made.

MR. HUGHES, in opening the defence, said there was nothing novel in the mixture of a finely-divided metal with an organic binding material when Just and Hanaman published their specification in 1904. That idea was quite well known in connection with osmium filaments. Of the mixture of tungsten and binding material, Just and Hanaman said that filaments were to be formed "in the usual manner." On that a question would also arise. In defendants' view, the usual manner in 1904 was what was called by way of distinction the soft-paste process, a process by which a relatively small quantity of metal mixed with a relatively large quantity of binder was squirted through a die at a pressure of a few pounds to the sq. inch. The process by which a paste, so hard that it was to the touch almost like metal, was squirted through a die of less than $\frac{1}{250}$th of an inch at a pressure of 20 tons to the sq. inch was subsequent to 1904. Again, for the purpose of carbonising the filament, Just and Hanaman prescribed that electric current should be passed through it. That was an essential part of the specification. In fact, the only way of heating the filament for this purpose known at that time was by the passage of current through it. It was said on behalf of the plaintiffs that the only object of passing the current through the filament was to raise it to a high temperature. But the language of the specification would indicate that it must be done in this way. At any rate, no one could tell in 1904, and he doubted if anyone could tell now, whether the results of passing a current of electricity through the filament and the results of external heating would be the same. It was obvious that the results might be totally different.

HIS LORDSHIP: I should say no one could tell.

MR. HUGHES: No one knew at that date. But, my Lord, the patentee is in this position. He has said: Do it by the passage of current. If he knew at that time it could be done in another way, he was bound to say so. If he did not know, and a new process has arisen since then, it is not within the patent. Proceeding, counsel submitted that if the patentee knew that this process could be carried out by external heating, he had carefully excluded it from the patent. At any rate, he knew that if he claimed that it could be done by external heating, and it turned out that it could not, the validity of the patent would be jeopardised. Moreover, the passage of current through the filament was essential to the equalising process, necessary when dealing with the soft-paste filaments of 1904, but unnecessary when dealing with the harder filaments it was now possible to turn out. Such as it was, the patentee had obtained the advantage of limiting the patent. With that he must also take the disadvantages. The defendants did not use the passage of current through the filaments at all. The filaments were taken in bundles of some hundreds at a time and heated in a furnace. True, the furnace was electrically heated; but that was a mere method of getting the heat and was immaterial. The defendants used a furnace heat instead of heating by current; and the practical difference there was enormous. For one thing it saved the direct handling of each of these minute filaments. But, in truth, the two systems were hardly capable of being compared. On this point he submitted there was clearly no infringement. The next point to be considered was one to which most of the evidence had been directed. That was the atmosphere in which the removal of the carbonised binder was to be carried out. On that point Just and Hanaman were clear. According to the specification sued upon, that was to be done in an atmosphere of hydrogen and water vapour introduced for the purpose. Plaintiffs now said it did not mean that at all; but that if hydrogen were introduced and if in the process water was formed that was using an atmosphere of steam and hydrogen. In his submission that was an entirely extravagant proposition.

HIS LORDSHIP: I am sure there is a case in which something was recommended to be done, and it was found that some part of the process did that itself.

MR. HUGHES: A very well-known case in which the alleged infringer was held not to have infringed on account of that.

MR. WALTER dissented.

MR. HUGHES (proceeding): Said that according to this specification at any rate no one could doubt that steam was meant to be introduced. If plaintiffs' view were right and sufficient moisture were necessarily generated in the process, why was steam mentioned at all? It would have been sufficient to say: do it in an atmosphere of hydrogen which, in the course of the process, will produce water, and that will perform the process of oxidation. But the specification did not say that. Nor, if the "Z" case showed anything, had it been the view of the plaintiffs hitherto. Presumably the writ was issued without knowing how defendants' filaments were made. But by inspection granted in August, 1914, plaintiffs discovered:—

1. That defendants did not produce their result by the passage of an electric current through the filaments, but by external heating.

2. That the hydrogen defendants used was dry, and, therefore, plaintiffs' preconceived ideas were knocked on the head at once.

3. That the defendants had an alternative process, which was carried out in a vacuum with substantially the same result. That must also have been a great surprise to them. Proceeding, counsel said that, in fact, they found that the production was carried out without any of the things on which plaintiffs had relied throughout as constituting the invention. Thereupon they set about to evolve a new theory which was now enunciated as the production of some water in the process. How that could be described as the use of an atmosphere of steam and hydrogen he failed to see. Moreover, the hydrogen defendants used was not only dry, but it was used in a rapid stream which immediately removed whatever products were formed in the process. So that instead of using this water vapour, if, in fact, it were produced, that water vapour was being carried away as rapidly as possible. It was not wanted for the alleged reaction. What defendants said happened was

this: There was some oxygen in the filament in the form of oxide of tungsten, and that combined direct with the carbon or carbide and passed off in the form of carbonic oxide. Doubtless it was difficult to say with any certainty what really happened. Scientists appeared to differ considerably. But as the onus was on the plaintiffs, it might not be necessary to decide that point absolutely. The plaintiffs' theory that in the vacuum process hydrogen and water were produced, although the process was commenced without either steam or hydrogen, was more extravagant still. But whether they were right or wrong, one cardinal fact remained. The process was not carried out in an atmosphere of steam and hydrogen, but in a vacuum. Therefore, in the process of carbonisation to be performed by direct current, according to Just & Hanaman, there was no infringement by the defendants; and in the removal of the carbon there was no infringement. The third essential in the process described by Just & Hanaman was the equalising process, which modern developments had rendered unnecessary, and in that respect also there had been no infringement. On the issues of anticipation and want of subject-matter, it was clear that the idea of using tungsten for electric lamp filaments was not new at the date of the specification sued upon. It was mentioned in Just & Hanaman's own German specification as nothing new. It was also referred to by Bottome, by Lodyguine, and in Siemens & Halske. The only point was how it was to be used. The process of building up a filament by taking metals or carbon and mixing them with an agglutinant, squirting the mixture through an orifice, and burning away the binder, was also well known. In fact, it was described by Welsbach in 1898 with reference to osmium and other metals of the platinum group. It was also well known that tungsten was a most suitable metal for filaments, and perhaps the most suitable. All Just and Hanaman did was to say: Try a known process suitable to some metals with other metals, or, rather, another metal which is the most suitable for the purpose for which you want it. There was very, very little invention, if any, in that.

His LORDSHIP: There was no reason to suppose it would not work.

MR HUGHES: Apparently not, and when it was applied it was found it would work. Proceeding, Counsel said that everything else in the specification was known. The only thing which could possibly be described as novel was the direction: Try tungsten. No one had thought it worth while to put "Try tungsten" into a specification, possibly because most people would have thought there was no subject matter in it.

Besides, this specification did not contain a satisfactory method of carrying out the process.

(To be continued.)

Re GROSSE, LTD.

IN the matter of the Companies' Acts and Allen *v.* Grosse, Ltd., an application was made before Mr. Justice Barton, in the Irish High Court, and granted, for the dismissal of a petition for the winding up of Grosse, Ltd., carrying on business as electrical and automobile engineers and agents at 35, Queen Street, Belfast. The applicants were the petitioners, Messrs. Pritchetts & Gold, Ltd., London, who were creditors for £172, and who stated that since Mr. W. G. Kennedy had been appointed liquidator an arrangement had been made by which all the estate of the company had been sold to Mr. Geo. Allen, who had been manager, and a term of the agreement was that Mr. Allen and his wife should release certain claims against the company. The result, it was considered, would be that the creditors would receive 6s. 8d. in the £, whereas if liquidation was proceeded with, it was likely that nothing would be left for the creditors.

Re G. H. TURNER & CO., LTD.

A PETITION by Siemens Bros. Dynamo Works, Ltd., for the winding up of G. H. Turner & Co., Ltd., was before Mr. Justice Neville, sitting for the disposal of company business on Tuesday, July 6th. Counsel for the petitioners stated that an arrangement had been come to, and he now asked for leave to withdraw the petition, without costs. His Lordship sanctioned the withdrawal of the petition accordingly.

OPPENHEIM *v.* GREWING.

IN the Chancery Division, on Friday, Mr. Justice Eve granted the application of Mr. Harry James Oppenheim for the appointment of a Receiver of £15,000 worth of the plaintiff's shares in the Oriental Telephone and Electric Co., Ltd. The defendant was Mr. Henry Grewing, a former director of the company, who, it was alleged, held the shares. His Lordship also ordered that the Receiver should collect the dividends of the shares pending the action.

THOR COTTON SPINNING CO. *v.* SIEMENS BROS. DYNAMO WORKS, LTD.

THIS action was mentioned to the Lord Chief Justice, in the King's Bench Division, on Monday. It was stated that the claim was for about £15,000.

MR. MCCARDIE asked for a postponement of the hearing of the action, because a material witness of the defendants was an alien in Germany.

MR. LANGDON, K.C. (for the other side), said it was not suggested that the witness could not return by licence of the Crown.

His LORDSHIP: Do you think the licence would be granted?

MR. LANGDON said he did not think the case would be heard before the Long Vacation, and eventually his LORDSHIP said it could be mentioned again in October, when the Courts would sit again.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Reserve Officers' Training Corps.

On examining the daily casualty lists one can but realise, considering the enormous loss of officers during the period of *defensive*, which is now occurring in our Forces, that when the great *offensive* is taken the casualties will largely increase in the percentage of officers placed out of action either through being killed or wounded.

There is no doubt that there is a large number of professional men of military age, ranging from 30 to 45, holding responsible positions in the profession, who are not engaged directly in supervising the manufacture of shells and other armaments, but who are employed in railway, gas, electricity and other engineering branches, and who, by virtue of their positions, are men who are used to the organisation of labour and the carrying out of routine work, and who have throughout the course of their theoretical training acquired facility in taking notes at lectures, and who would be available (provided they put themselves in training at once) as reserve officers in branches in which military strategy and tactics are not required so much as the organisation of labour and engineering knowledge, and I venture to put forward the suggestion that the Institutions should endeavour to see whether such Reserve Officers' Training Corps should not be formed, having branches in London, Manchester, Newcastle, and other centres, with the object (should it be necessary) that the members of such corps might be drafted into the Army Service Corps, Army Service Corps (Labour Section), the Royal Engineers, and, if necessary, the Artillery.

It is quite evident that men with such experience would be far more valuable than many of the young subalterns who are taken straight from college, and who have neither experience in the handling of men nor initiative in dealing with difficult problems which require immediate action.

It is, of course, understood that the first thing to do would be to ascertain how many men were physically fit, and also to make it understood that enrolment made it compulsory to attend at lectures either in the afternoon or the evening, with a view to becoming efficient; whilst there is also to be considered the fact that difficulty might arise over such reserve officers being released from their present employment, seeing that their employment might be a public necessity or that they might be on war service.

Station Engineer.

BUSINESS NOTES.

Trade Announcements.—The business of Messrs. J. F. and G. Harris has been turned into a limited company under the title of J. F. & G. HARRIS, LTD. The company has been registered with a capital of £16,000, divided into 13,000 cumulative 3 per cent. preference shares of £1 each, and 24,000 ordinary share of 2s. 6d. each, to purchase the goodwill, stocks and book debts, and to take a tenancy of the leasehold premises in Wilson Street, Finsbury, and Bevenden Saw Mills, Hoxton, and the company has entered into possession and discharged the purchase consideration. The directors of the company are Messrs. P. L. Mott, of Browning and Co., Cannon Street, E.C.; H. G. Nutman, of Nutman & Son, Gracechurch Street, E.C.; and W. Goff, of Messers, Ltd., Gracechurch Street, E.C. Mr. Edward Harris has been appointed manager of the company.

The title of the General Cable Manufacturing Co. is now the GENERAL CABLE MANUFACTURING CO., LTD., and its address is Imperial House, Kingsway, London, W.C.

THE WESTINGHOUSE BRAKE CO., LTD., chain department, London, N., have notified their customers in Leeds and district that they have decided to close the Leeds office until the end of the war. All communications are to be sent to the London head office in York Road, King's Cross.

Dissolutions and Liquidations.—ALUMINIUM PATENT NON-FLUX SOLDER, LTD.—This company is winding up voluntarily, with Mr. C. Waterhouse, of 10, Camomile Street, E.C., as liquidator.

SMETHWICK BOILER COVERING CO., Smethwick.—Messrs. H. E., A. D. & C. W. Jones have dissolved partnership. Debts will be attended to by the last two of these gentlemen.

KAY & CO., electrical and mechanical engineers, Ecclesfield Works, Ecclesfield.—Messrs. A. A. Kay, G. H. Sykes Carter, and C. E. Carter have dissolved partnership. Mr. A. A. Kay will continue the business under the same title.

Portable Tools.—THE WESTMINSTER TOOL AND ELECTRIC CO., of Suffolk House, E.C., inform us that they have discontinued the use of the name "Vulcan" in connection with their electric tools. In future these portable electric drills, blowers, and lifting magnets will be known by the registered trade-mark—"Westool."

Book Notices.—*Journal* of the Institution of Electrical Engineers. Vol. 53, No. 250. June 15th, 1915. London: E. and F. N. Spon, Ltd. Price 3s. 6d. Also the index to Vol. 53.—This issue, the last until next session, contains papers on the "Magnetic Behaviour of Iron under Alternating Magnetisation," by N. W. McLachlan; "Incremental Armature Copper Losses at No-Load and Armature Teeth Eddy-Current Losses," by A. Press; "Notes on the Cooling of Condensing Water," by C. S. Jeffrey; "Good Lighting," by V. H. Mackinney and E. Stroud; "The Utilisation of Waste Heat for the Generation of Electrical Energy," by H. Hobson; "Modern Power House Condensing Plant," by A. Arnold; "Notes on Modern Methods of Electric Welding," by H. S. Marquand; and the fourth list of members on military service. The pass list for the Associate Membership examination held in April contains the names of five successful candidates.

The Slide Rule. By C. N. Pickworth. Manchester: Emmott and Co., Ltd. Price 2s. net.—This, being the thirteenth edition of a standard work, needs no recommendation. The contents have been revised, and descriptions of various new slide rules and calculators have been added, as well as a note on the extraction of fifth roots.

International Correspondence Schools, Ltd., has sent us an advance proof of a pamphlet on "Electrical Industries"—one of a series intended to cover the principal industries under the general title of "The Recapture and Expansion of British Trade," which will be sent to the I.C.S. students. Copies of these papers may be had on application.

We have received an advance copy of a new prospectus that is being issued by the Wholesale Hardware Club, Ltd. (14, Finsbury Square, E.C.). The President (Mr. F. A. B. Lord) calls for an increase of membership from 300 to 500 during the current year.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXI, part 3. June, 1915. Newcastle-upon-Tyne: The Institution. Price 5s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXIV, No. 7. July, 1915. New York: The Institute. Price $1.

Circular of the Bureau of Standards, No. 20, "Electrical Measuring Instruments." Washington: Government Printing Office.

"*Transactions* of the Illuminating Engineering Society." Vol. X, No. 4. June 10th, 1915. New York: The Society. Price 75 c.

"The Near-Eastern Problem and the Pan-German Peril." By Vladimir Yovanovitch. London: Watts & Co. 6d. net.

City and Guilds of London Institute: Report of the Council for 1915, and Programme of the Technical College, Finsbury. London: The Institute.

Catalogues and Lists.—MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—No. 2 of the new series of *Installation News* contains, in addition to some opening editorial notes and some "remarks at random," illustrated articles on the correct illumination of shop windows, the illumination of factories, English manufacturers and American guarantees, an account of the company's new premises at Liverpool, and matter relating to the Simplex ironclad distribution boards, the Brilliant cleaner, and Simplex lighting fittings. Copies will be sent on application.

THE EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—No. 2 (Vol. 1) of *Ediswan Electric Service* contains notes on the development of lamp manufacture (continued from No. 1), and illustrated particulars of the Ediswan Dimmer switch, electric fans, the Pygmy heater, the "Ediswan Imperial" vacuum cleaner, and artistic fittings, also a view of the company's showrooms and extracts from a letter from the firing line, accompanied by a photographic reproduction of a shrapnel-riddled motor headlight and "Royal Ediswan" lamp—the latter, of course, intact.

THE WHOLESALE ELECTRICAL CO., LTD., 54-56, Oxford Street, W.—Fully illustrated price list of electrical accessories, including many patterns of lampholder, with and without key switches, adapters, tumbler switches of various types and sizes, switch plates, button switches, plugs, ceiling roses, cut-outs, &c., also ironclad switches, distribution boards, electric radiators, and ornamental lighting fittings. A series of views of the firm's workshops in London are included.

MESSRS. LANDIS & GYR, LTD., Willesden, N.W.—16-page illustrated price list of ampere-hour meters with friction compensating device.

MESSRS. AUSTIN WALTERS & SON, 57, Lower Mosley Street, Manchester.—20-page catalogue containing illustrations and prices of various designs of electrical advertising signs for restaurants, shops, garages, &c., also window signs, theatre signs, gilt wood letter signs, electric sign flashers, and time switches. A second publication, of eight pages, describes and gives tabulated prices of arc lamp resistances, cinema theatre dimmers, sliding contact resistances, and liquid resistances for A.C. and D.C.

For Sale.—Gloucester Corporation has for disposal a quantity of hard drawn copper trolley wire, scrap copper cable, brass, and other metals. Particulars are given in our advertisement pages.

Patent Application.—Application for restoration of Patent No. 10,676 of 1910, for "Improvements in reinforced concrete telegraph poles and the like," has been made by Ricardo Esparza.

Bankruptcy Proceedings. — BOULT, J., & BOLT, J. H. (firm, John Boult, electricians, Grosvenor Street, Chester.—Receiving order granted on debtor's petition, June 28th. First meeting July 14th, public examination July 27th—both at Chester.

LIGHTING and POWER NOTES.

Aldershot.—L.G.B. INQUIRY.—An inquiry was held on July 1st into the application of the U.D.C. for an urgent loan of £8,500 for new plant for the electricity works.

Batley.—YEAR'S WORKING, &C.—There was a profit of £634 on the Council's electricity undertaking for the year ended March 31st, 1915. In the previous year there was a loss of £116. The price of energy supplied for lighting is to be increased 7½ per cent., and for motive power 15 per cent., with a minimum charge of 1d. per unit for supplies to motors of 5 E.H.P. (demanded) and under.

Belgian Congo.—At Elizabethville, Katanga, the Union Minière du Haut Katanga has a 745-KW., three-phase, 60-cycle, 550-volt plant in operation at its smelting works, and another 425-KW. plant of the same type is to be erected towards the end of the year. At the same company's copper mines at Etoile du Congo and Kambore, 180 and 60-KW., three-phase, 60 cycle plants are also in use. Several small lighting plants are in use in Elizabethville, for the railway station, cinema, offices, &c.

Bitterne.—The Southampton Gas Light and Coke Co. has petitioned against the Bill of the Southampton T.C. to confirm the prov. order for supplying electricity to Bitterne, and the T.C. is taking steps to support the Bill and prov. order.

Bristol.—L.G.B. INQUIRY.—Last week an inquiry was held into the application of the T.C. for sanction to borrow £27,295 for the purchase of a 6,000-KW. turbo-alternator, piping switchgear, &c., and to cover £1,398 excess expenditure. It was pointed out that the normal capacity of the power plant was 9,900 KW., and that it carried a load of 4,947 KW. on March 25th last, but since that date contracts for further supplies had been entered into, making a total of 7,185 KW., and leaving a margin of only 2,715 KW., or less than the capacity of one of the largest units of plant, viz., 3,000 KW. It was pointed out that amongst the firms supplied were many engaged in Government contracts. Some opposition was shown to the proposed loan, Mr. Elvey Robb appearing for the Ratepayers' Association, while several speakers appeared to doubt the real need for the extension. The question of the availability of the Temple Back plant was raised, and Mr. Robb suggested that the L.G.B. should investigate the exact position of the plant, stating, however, that his clients would not oppose the application if a real necessity for the plant were shown.

Burnley.—PRICE INCREASE, &C.—The following increases in the price of energy are being recommended for adoption:—Lighting, heating and domestic purposes, ¼d. per unit; power, 5 per cent.; traction, '05d. per unit.

The E.L. Committee has informed the Burnley Paper Works Co., which is a possible consumer of over 100,000 units per annum, that it cannot reduce its price below '7d. per unit.

Canada.—The Electric Power Co., which has absorbed 27 electrical undertakings between Toronto and Kingston, has contracted with the Dominion Government for all power developed on the Trent Valley Canal. The transmission system in use is 44,000 volts, three-phase, 60 cycles, and it is estimated that up to 75,000 H.P. can be developed.

Chester.—HYDRO-ELECTRIC WORKS RESULTS.—During the past 12 months 1,459,500 units were generated at the Corporation hydro-electric works of which 15,679 were used for pumping sewage, 1,659 for lighting the works, 63,232 by excitation and feeder booster, 117,209 in the distribution cables, and 1,261,721 were sold to consumers. The cost of operating these works in producing the above quantity of electrical energy was as follows:—Oil and stores, £39; wages, £249; repairs and maintenance, £22; rent, £100; rates, £136; insurance, £1; part general establishment charges, £100. Total works charges, £647, *i.e.*, '123d. per unit sold. The capital charges were interest on loans, £460; sinking fund charges, £484; total capital charges, £944, *i.e.*, '179d. per unit sold, making in all '302d. per unit sold. Taking the income per unit sold at 1d., as in the original estimates, the undertaking shows a surplus of £3,665 on the year's working.

Colne.—PRICE INCREASE.—In view of the increased price of coal, the Corporation has increased the charge for energy for power purposes by ¼d. per unit.

Coventry.—YEAR'S WORKING.—The returns of the Corporation electricity undertaking indicate, as usual, striking progress during the last financial year, when over 20¼ million units were sold, as compared with 16,300,000 in the previous 12 months. It is interesting to note that of the above, some 18,430,000 units were sold at an average price of '72d. per unit, the total average for all supplies being '92d. per unit. That such prices are justified in Coventry can be gathered from the fact that the total revenue amounted to £77,913, as compared with £71,207 in 1913-14; the total works costs amounted to £29,688 (35d. per unit); capital charges to £21,941 ('26d. per unit); special charges to £3,192 ('038d. per unit); and public lamps, £262 ('003d. per unit); making a total commercial cost of £55,083 (or '652d. per unit). Thus the net profit for the year was £22,830, and with a small surplus brought forward, made £23,148, which was carried forward. The previous year's carry forward was £21,943. The

reserve fund balance amounted to £9,005, £13,250 having been transferred for capital purposes during the year; the E.L. Committee recommended that the balance in hand, £23,148, should be disposed of as to £17,148 to the reserve fund, to be expended on capital account, and £6,000 to the general district fund. The maximum load for the year was 10,584 KW.; and the connected load included 1,160 motors, of 15,345 H.P.; the load factor was 21·8; and 2·95 lb. of coal was burnt per unit sold, the fuel cost amounting to ·185d., inclusive of destructor steam. The average revenue per 8-C.P. lamp was 2s. 9d., and the number of consumers 3,889.

Continental Notes.—RUSSIA.—Whilst the Petrograd Town Council is thinking over the question of turning the Finnish waterfalls to account for the production of electric power, an English company, says the *Novoie Vremya*, has acquired the right over the Imatra Falls. The company inquired of the chief of the town on what terms and conditions the town would use current generated by the falls named, for lighting and for industrial purposes; "but, just having become free of concessionaires, there is no reason to put on the manacles of concession again."

GERMAN "WAR WIRE."—Owing to the scarcity of copper, the German Government regulations with regard to electrical installations have been so far relaxed as to admit the use of conductors of zinc in place of copper in low-pressure installations.

Dalkeith.—PRICE INCREASE.—The Electric Supply Corporation, Ltd., is raising the price of energy for lighting to 5½d. per unit, and for domestic heating and motive power to 2d. per unit.

Darwen.—The Electricity Committee has decided that the following clause be endorsed on all statements of accounts for the electricity department:—"The Corporation will not supply or fix internal fittings, except meter and main fuse, on consumers' premises, and at the meter their responsibility ends. The responsibility for all wiring, fittings and apparatus on the consumer's side of the Corporation main fuse, whether tested or not by the Corporation, rests solely with him."

Edinburgh.—The City electrical engineer has reported to his Committee as to the impracticability of further reducing his staff for war services. While mains laying could be delayed, it would hinder the development of the undertaking. The greater part of the work involved in supplying the extended area, including Cramond, Corstorphine, Liberton and Newton has been completed.

Erith.—PROPOSED LOAN.—The U.D.C. has decided to apply to the L.G.B. for sanction to a loan for the provision of additional plant at the electricity works. The full scheme is estimated to cost £20,000, but it is intended to limit present expenditure to £15,300.

Finchley.—YEAR'S WORKING.—The accounts of the electrical undertaking for the year ended March 31st last show that the income was £23,976, and the working expenses £12,025, leaving a balance of £11,951, which, after the repayment of interest on loans, &c., left a clear balance of £7,902.

At the meeting of the Council, last week, it was agreed that the price for current for private lighting and street lighting be increased by 10 per cent. It was pointed out that next year it was estimated that there would be a deficit of £2,000, and only about £1,300 to meet it with.

Guiseley.—E.L. SCHEME.—The U.D.C. has been informed by the Electrical Distribution of Yorkshire, Ltd., that it intends making application for powers to supply electricity in the Guiseley Urban District. The company states that it believes it can offer a supply more cheaply than could otherwise be obtained. The matter has been referred to the Committee considering the joint electricity scheme for the district.

Halifax.—PROPOSED LOAN.—The Tramways and Electricity Committee is asking the T.C. for permission to make application to the L.G.B. for sanction to borrow £24,000 for additional plant, consisting of one 5,000-KW. turbo-alternator, surface condenser, cooling towers, and water-tube boiler, in connection with the electricity undertaking, and for power to accept tenders for the work.

The present charges for electrical energy for motive power purposes are to be increased by 12½ per cent.

Hendon.—ELECTRICAL DEMONSTRATION.—The Hendon Electric Supply Co., Ltd., has held a series of demonstrations at Golder's Green. The lines adopted were somewhat novel, the hall being invitingly laid out with small tables provided with electric kettles, teaball teapots and toasters, at which during the interval the guests made their own tea. Various useful domestic appliances were also displayed on the tables for inspection, and as the guests arrived the use of them was explained by the company's staff in attendance. Mrs. Lewis gave practical cookery lectures, and prepared the bread, cakes, pastries, &c., for afternoon tea. Mrs. Maud Lancaster explained the use of various domestic electrical apparatus, and lectured on the comfort of an electric home. The demonstrations were organised by the engineer, Mr. B. G. Drummond, the cookers being supplied by the General Electric Co., Ltd., the Brompton and Kensington Accessories Co., Ltd., Messrs. Ferranti, Ltd., and the Bastian Co., Ltd.

India.—OVERHEAD WIRES.—The Government of Bombay recently appointed a Committee to inquire into the accidents that have occurred in Bombay through broken telephone wires coming into contact with tramway and other wires carrying high-pressure electric currents. The Committee consisted of Mr. H. P. Gibbs, chief engineer, Tata Hydro-Electric Power Supply Co.; Mr. E. L. Bagshawe, superintendent of telegraphs; and Mr. F. W. Wilson, officiating electrical engineer, Electrical District. Since overhead mains were introduced into Bombay four fatal accidents have occurred. The Committee has made certain recommendations, which the Bombay Electric Supply and Tramway Co. and the Bombay Telephone Co. have been requested to give effect to, with the view of such accidents in the future being reduced to a minimum.—*Times of India.*

Kirkcaldy.—YEAR'S WORKING.—For the year to May 15th last, the total income of the Council's electricity undertaking was £12,295, and the gross profit £4,866, while, after meeting financial charges, a surplus of £524 remained, as against an estimated net profit of £1,245, which it is thought would have been realised but for the war. The coal consumed was 9·92 lb. per unit sold (costing ·320d.), as against 12·18 lb. (costing ·460d.) the year before, and this would have been lower had the turbine plant been available all the year. The maximum load was 950 KW., load factor 22·5 per cent., units sold 1,880,193, and B.H.P. of motors connected 1,688. Owing to the abnormal price of coal, a deficit of £2,928 is estimated for the present year.

Leeds.—During a severe thunderstorm last week considerable trouble was caused at three electricity sub-stations owing to flooding, and consumers on the mains connected with these sub-stations were deprived of current for a time.

London.—L.C.C AND LOAN SANCTIONS.—The Finance Committee, with the approval of the Treasury, has agreed to the borrowing of £500 by the Shoreditch B.C. for electricity meters, but has asked to be furnished with a list of the consumers and their trades to be supplied by the meters under the sanction, it being understood that the meters are required for war services. H.M. Treasury has now agreed to a suggestion by the L.C.C. that it should sanction loans for electricity mains, house services and meters, without applying to the Treasury beforehand, provided that such loans appear to be reasonable and required in connection with work for the War Office and Admiralty. The Metropolitan Borough Councils have been informed of this arrangement.

WOOLWICH.—The B.C. is to apply to the L.C.C. for sanction to the borrowing of £1,450 for mains; £1,027 for transformers; £965 for switchgear; and £180 for hire rentals. The loans are to cover expenditure incurred, or to which the Council is committed.

The Finance Committee has considered the question of linking up with the South Metropolitan E.L. and Power Co. in order to give certain urgent supplies, and recommends that application be made to the L.C.C. for sanction to borrow £4,700 for cable and transformers required; in the event of refusal by the L.C.C. to sanction the borrowing of £2,172 for wiring certain Government houses, an appeal is to be made to the L.G.B.

BERMONDSEY.—The Electricity Committee reports the receipt of a notice of objection to the quinquennial assessment of the electricity undertaking. The present valuation of the undertaking is £9,090 gross and £3,030 rateable, and the undertaking has been put in the new valuation list at the same figures. The County Council contends that the new figures should be £11,000 gross and £4,000 rateable.

Luton.—YEAR'S WORKING.—During the last financial year the Corporation Electricity Department sold 8,381,000 units, including some 304,000 for traction. The maximum load was 3,189 KW., and the connected load included 5,996 H.P. of motors and 1,465 KW. of heating apparatus. The total income was £32,822 and the gross profit £13,773, as compared with £11,668 in the previous year, representing 10·65 and 11·42 per cent. respectively on the capital expended. The net profit, £4,430, which compares with £4,793 in the previous year, was carried to the appropriation account, and the latter, after deductions for house services, meters, balancer replacement, bonus, &c., stands at £6,803; in addition, the department has a reserve fund amounting to £6,401.

The T.C. proposes to apply to the L.G.B. for permission to borrow £4,000, being the balance of a loan of £24,000 sanctioned for electricity purposes in 1913.

Lytham.—BULK SUPPLY.—In connection with the proposed scheme for taking a bulk supply of electricity from St. Annes, it has been decided that the agreement shall run for 10 years from the date of the L.G.B. sanction to the loan.

Maidenhead.—The T.C. has decided to invest in the new War Loan £1,000 of the E.L. reserve fund, and £300 of the E.L. insurance fund.

YEAR'S WORKING.—The gross profit on the electricity undertaking for last year was £4,705, and the net profit £637, both items being an improvement on the previous year. The bulk of the output was generated by the Diesel plant, but oil fuel cost 68s. per ton, as against 47s. in the previous year.

Manchester.—YEAR'S WORKING.—The annual report of the Manchester Electricity Committee shows a net surplus of £34,926, compared with £36,006 in 1914. The sum of £30,000 has been devoted to the relief of the rates, and the balance to

capital outlays for which no borrowing powers exist. The surplus was reduced by reason of war service allowances, amounting to £6,015, and additional income-tax of £3,283.

The total revenue for the year amounted to £543,546, as compared with £513,589 in 1914, while working expenditure, exclusive of depreciation, amounted to £298,444, leaving a gross balance of £248,102, as against £237,105 in the previous year. Interest and sinking fund payments called for £180,453; loan instalment to P.W. Commissioners amounted to £7,105; £25,618 was transferred to renewals suspense account, and the net surplus of £34,926 dealt with as stated previously. The renewals account balance now amounts to £185,974, and the reserve fund to £11,515.

The total units generated were 162,699,530, of which about 98,000,000 were sold for lighting and power—the latter taking well over 80,000,000; 29,000,000 units were sold for traction, and the total units sold were 127,750,000. Nearly 12 000,000 units were used on the works, and distribution losses, &c., accounted for 23,000,000. The maximum load was 50,460 KW., of which traction accounted for only 10,440 KW.

The L.G.B. sanction for the borrowing of £424,220 for the establishment of the electricity generating station at Barton, provides the following periods for repayments:—£121,770, repayable within 30 years; £49,500, within 20 years; £126,850, within 17 years; £105,780, within 15 years; £15,480, within 10 years; and £4,840, within 7 years.

The Tramways Committee has granted permission to the Electricity Committee to utilise tramway poles in connection with the electric lighting of Oldham Street, one of the principal central shopping thoroughfares in the city.

Maidstone.—LOAN SANCTION.—The T.C. has received sanction to a loan of £4,800 for new plant, this representing the estimated cost, less £2,150 received from the sale of three small generating sets, and £500 to be transferred from the revenue account.

Nottingham.—PRICE INCREASE.—The Electricity Committee proposes to increase its charges for energy by 12½ per cent.

Oldham.—YEAR'S WORKING.—The electricity accounts for the past year show that the gross revenue was £52,580, and net profit £3,549. The output for private lighting during the year was 2,018,603 units, an increase of 134,377; for power, 2,779,150 units, an increase of 924,554; and for traction 3,158,753 units, a decrease of 132,855.

Plymouth.—PRICE INCREASE.—The T.C. has decided to increase the price of electric current for lighting by a farthing per unit after September.

Reigate.—YEAR'S WORKING.—Referring to the annual balance-sheet of the electricity undertaking, the chairman recently pointed out that a profit of £206 was shown, being £85 more than estimated. They had lost a good deal of revenue by the war, but the output was 28,000 units higher. Both coal and oil fuel were increasing in price, but the Committee was reluctant to increase the price of electricity. The reserve fund stands at £2,824 on a capital of £35,612.

Ripon.—E.L. SCHEME.—The City Council has decided, after consideration of a communication from its Parliamentary Agents, not to make any order in respect of an electric lighting scheme for the city.

Rochdale.—LOAN SANCTION.—The T.C. has received a letter from the L.G.B. sanctioning loans for £20,171 for the electricity undertaking, and stating that the Board does not see its way to approve any loans at the present time in respect of the expenditure on electricity mains.

The Electricity Committee recommends an increase in the price of electricity by 10 per cent. for lighting and 15 per cent. for other purposes as from the inspection of meters now proceeding.

Runcorn.—The B. of G. has decided to ask the borough electrical engineer of Warrington to report upon the condition and adequacy, or otherwise, of the electric lighting plant at the Children's Homes.

Shipley.—The Electricity Committee has decided, owing to the largely increased price of steam coal, not to enter into contracts at the present prices, and that arrangements be made to purchase coal according to requirements.

The Council has decided to consent to the Bradford Corporation supplying electricity to Dumb Mill on condition that the Corporation enters into an agreement authorising the Council to continue its supply of electricity in the Bradford area.

Spenborough.—During a thunderstorm last week—which affected the whole of the West Riding of Yorkshire—damage was done to one of the dynamos at the electricity works of the Council; there was, however, no shut down in the supply.

Spennymoor.—RESTRICTED LIGHTING.—On account of the suspension of public lighting, the Electricity Supply Co. has reduced the public lighting account of the U.D.C. by £78.

Stalybridge.—YEAR'S WORKING.—The accounts of the Joint Board's electricity department for the past year show a revenue of £49,071, and expenditure of £22,934, leaving a gross profit of £26,137. After paying £10,234 for interest and special payments and £11,641 to sinking fund, there was a surplus on the year's working of £4,170, as against £8,257 in the previous year. During the past year 22,683,680 units were generated, of which 1,850,354 units were used on the tramways, 6,582 for public lighting, 813,152 for private consumers' lighting, 16,004,499, for private consumers' power, and 1,134,184 were used on works, making the total quantity accounted for, 19,809,771.

Sunderland.—YEAR'S WORKING.—The annual report of Mr. A. S. Blackman, borough electrical engineer, states that there was a decrease of 2½ per cent. in the units sold as compared with the previous year, the sales being 14,499,124 units. During the year five new sub-stations were completed. The total revenue was £73,517; in the sales department work executed and goods supplied totalled £5,775. The total working expenses amounted to £32,880, and the surplus, £33,550, was dealt with as to £10,277 for interest, and £16,640 for the repayment of loans, and after meeting other smaller liabilities, £4,653 was carried to the depreciation and renewals account.

Torpoint.—The Electric Supply Co., Ltd., having completed the lighting arrangements for the town, has asked the U.D.C. to consider the return of £100 deducted from its account owing to delay in completing the contracts, with such deductions as will fully reimburse the Council for all the special outlays it has incurred.

West Bromwich.—The Electricity Committee recommends an agreement being entered into with the Wellington Tube Co., Ltd., for a supply of electricity of a minimum quantity of 80,000 units per annum, for a period of five years.

TRAMWAY and RAILWAY NOTES.

Belfast.—FEMALE LABOUR, &C.—At the monthly meeting of the Corporation last week it was decided, if necessary, to engage women as tram conductors to replace men who had joined the Colours; it was further decided not to employ in the tramway department any fit man of military age. It was intimated that it was found necessary to increase the rate of electrical charges by ¼d. per power unit, and ¼d. per lighting unit, owing to the increased cost of production. The staff of the tramway department has already given a good many of its members to the Ulster Division.

Bournemouth.—YEAR'S WORKING.—For the year ended March 31st last, the revenue of the Corporation tramways undertaking amounted to £102,346, and the total gross balance to £48,235. Interest, sinking fund, rent of leased lines, &c., amounted to £38,101, leaving a net profit of £10,134, or deducting loss on motor-'buses, £8,947. During the year nearly 17 million passengers were carried, and 1,815,632 car-miles were run. The percentage of working expenses to receipts was 53·8; and the track mileage of the undertaking 31½.

Burnley.—The T.C. has referred back a proposal to remove all restrictions as to the time at which discount tickets are available on the cars on all days except Sundays.

Doncaster.—FEMALE LABOUR.—The Corporation has decided to employ female conductors on the Avenue Road and Hexthorpe and Hyde Park routes, in replacement of some 30 men who have left the tramway department and enlisted in the Forces. The new conductors must be 25 years of age or over, and it is understood that preference will be given to wives of soldiers serving at the Front.

Dundee.—TRAMWAY ARBITRATION AWARD.—Mr. W. Allan Carter, C.E., Edinburgh, the arbiter in the case between the Corporation and the Dundee, Broughty Ferry and District Tramway Co., regarding the price to be paid by the T.C. for about a mile of the company's line, has issued his award. The formal claim of the company was for £14,500, and the Council offered £8,500. Mr. Carter proposes to award £9,255, with expenses against the town.

Kirkcaldy.—YEAR'S WORKING.—The Corporation tramway undertaking during the year ending May 15th carried 5,492,120 passengers, as against 5,781,895 in the previous 12 months. The total income was £16,977; the gross profit £5,525, and the credit balance, after meeting financial charges, contributions to depreciation, cost of 1910 Act, &c., was £33, as against an estimate of £1,040, the reduced figure being accounted for by the falling off of receipts due to the war. Based on present earnings, the undertaking should show a surplus of £70 for the present year, but if the price of energy is increased, as suggested, a deficit of £424 is expected.

Leyton.—ELECTRIC DUST VAN.—The District Council has had its attention called to the trials recently made by the Barnes District Council of an electrically-propelled dust van, and a Sub-Committee has been appointed to consider the matter and report.

Manchester.—WAR BONUSES.—The Tramways Committee has decided to offer to submit the application of a war bonus for certain classes of workers to arbitration by the B. of T.

Northampton.—In view of abuses in the use of military passes, the Tramways Committee proposes to cancel, as from July 1st, all free passes granted for military purposes, except those relating to nursing staffs.

London.—L.C.C.—Discussing the possibility of reducing redundant passenger services on the streets and releasing men, &c., for Government service, the chairman of the Highways Committee recently stated that the duplication of the Council's services by private enterprise would, he hoped, be the subject of an early report. 'Buses competed with the Council's tramways along 100 miles of route, and required 1,500 men to operate them, while the additional men required by the tramways to give the same service would be only 460.

City and S. London Railway.—Owing to the fusing of a cable, the traffic was dislocated for an hour on Saturday morning last, single-line working being, however, possible.

Fire Brigade Vehicles.—According to the annual report of the L.F.B., in addition to 15 petrol vehicles, there were added to the equipment during the past year two electrically-driven chassis, upon which have been mounted turntable ladders, and two electrically-driven motor escape vans.

Ramsbottom.—Railless Cars.—The second of the new cars for the railless traction system was put into service on the 1st inst., and the first of the old cars has been sent to Leeds to be fitted with new body, wheels and springs.

Rowley Regis.—The U.D.C. has decided to take no action regarding the expiration next month of the Quarry Bank, Brierley Hill, and Rowley Regis Light Railway Order, it being considered that, as the motor-'buses were serving the district adequately, it was doubtful if the tramway scheme could be carried out successfully.

Stalybridge.—Year's Working.—The accounts of the Joint Board's tramway undertaking for the past year show on revenue account an income of £37,620, and expenditure £32,049, leaving a gross profit of £5,571. Interest and special payments absorbed £8,282, and £7,785 was transferred to sinking fund, leaving a deficit on the year of £10,497, compared with a deficit on the previous year of £5,870. Car-mileage was 1,116,936, compared with 1,157,163 in 1913-14; and the passengers carried numbered 8,406,915, against 9,900,591. The average fare per passenger was 1·060d., against ·977d. last year; and the average number of passengers per car-mile was 7·706, against 8·556 in the previous year.

TELEGRAPH and TELEPHONE NOTES.

Canada.—In the course of a recent debate on the Marine and Fisheries Department Estimates in the Canadian House of Commons, the Minister of Marine announced that during the coming season the first wireless station will be placed on the Hudson Strait. This station will be able to work with those at Port Nelson and Le Bas.—*Wireless World.*

Postal Servants.—In the House of Commons, on Tuesday, Mr. Herbert Samuel stated that about 36,000 of the Post Office staff were serving in the Army and Navy, and arrangements had been made to release many more. General facilities to enlist could not be given to telegraphists, linemen, and other skilled workmen on the engineering staff, because many thousands of those classes were required at home for military and naval work. Every effort would be made to provide employment for disabled soldiers and sailors, and no more boys would be taken on as telegraph messengers where disabled men could be employed; the latter would also be given first consideration for employment as night telephone operators.

Russia.—The Russian authorities have decided to erect and equip a radio-telegraphic station at Nicolaieff, in the Odessa district, for the purpose of receiving time-signals from the Eiffel Tower, Paris.—*Wireless World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—Aug. 11th. One 1,000-kw. D.C. generator complete, liquid starter, &c., for the City Council. See "Official Notices" June 4th.

July 27th. A.C. and D.C. meters and maximum-demand indicators, for the City Council. See "Official Notices" June 25th.

August 11th. Victorian Railway Commissioners, Spencer Street, Melbourne. Twenty miles of vulcanised-rubber-covered electric light wire (Contract No. 28,925). Local representation. Deposit, ½ per cent. of amount of tender.*

Adelaide.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" July 2nd.

August 18th. Battery material, for the P.M.G. See "Official Notices" to-day.

August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G.'s Department. See "Official Notices" to-day.

Perth.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" July 2nd.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-kw. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; H.T. switchgear; H.T. mains. See "Official Notices" July 2nd.

Dublin.—July 12th. Corporation. 122,000 carbons. See "Official Notices" July 2nd.

Eccles.—July 19th. 4,000 tons of slack coal for the electricity works. Borough Electrical Engineer, Cawdor Street, Patricroft.

Edinburgh.—July 12th. Corporation. One 1,000-kw. motor-converter and transformer. See "Official Notices" June 25th.

July 14th. Corporation. Electric lighting installation at public wash-house, McLeod Street. Mr. F. A. Newington, Engineer, Dewar Place.

Erith.—July 19th. U.D.C. One 2,000-kw. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Hull.—July 22nd. Machinery oils for the Corporation Electricity Works.

Kingston-upon-Hull.—July 22nd. Corporation. One 5,000-kw. turbo-alternator with exciter; one condenser outfit complete. See "Official Notices" July 2nd.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" July 2nd.

Salford.—July 12th. Steel and concrete foundations for 5,000-kw. turbo-alternator. Borough Electrical Engineer, Pendleton.

South Africa.—Beaufort West (Cape).—September 14th. Municipality. Suction gas engines, dynamo, booster, switchboard, battery, &c.; also poles, copper, insulators, street lamps, service connections, meters, &c. Specifications, on deposit of five guineas (returnable), from Chas. G. Trevett, A.M.I.E.E., 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk, Beaufort West.

Spain.—The municipal authorities of Villanueva de los Castillejos (Province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

CLOSED.

Aberdeen.—The Corporation Tramways Committee has accepted the tender of the Tudor Accumulator Co. to make 300 new welded joints.

Batley.—The Electricity Committee has accepted the following tenders:—Crawshaw & Warburton, 1,500 tons coal; White Lee Colliery Co., 500 tons coal.

Bury.—The Corporation has entered into the following contracts for the electricity works:—

John Heaton and J. E. Southern & Co.—Coal.
Underfeed Stoker Co., Ltd.—Mechanical stoker.

Derby.—The Corporation Electric Lighting Committee has accepted the tender of Marshall & Plumtree, of London, for 10,000 carbons, at £25 15s. per 1,000; and those of the Hall Colliery Co., Ltd., Derby Coal Co, Ltd., Mr. T. Walker, Brookhouse, Johnson, Ltd., Parr & Sons, and Hill & Poyser for coal.

Eccles.—The T.C. Electricity Committee has recommended the acceptance of the tender of Messrs. Joseph Chapman and Sons for the construction of a coal bunker at the electricity works.

Hebden Bridge.—The Waterworks, Electricity and Watch Committee has accepted the tender of the Anglo-American Oil Co., Ltd., for the supply of fuel oil for the Diesel engine at the electricity works until December 31st, 1915.

Kendal.—The tender of the Wigan Coal and Iron Co., Ltd., has been accepted by the Electricity Committee for coal during 12 months:—Arley nuts, 23s. 6d. per ton; John nuts, 21s. 9d. per ton; Hewlett unscreened nuts, 22s. 2d. per ton.

Liverpool.—The Electric Power and Lighting Committee has accepted the tender of Messrs. J. G. Nicholls, Ltd., for the supply of glass for a period of three months.

London.—L.C.C.—The Asylums and Mental Deficiency Committee has accepted the undermentioned tenders for a period of four months from July 1st, 1915 :—

Electric sundries, Schedule 64.—A. F. Goodwin & Co. ; General Electric Co., Ltd. ; Veritys, Ltd. ; W. Geipel & Co. ; Cox-Walkers, Ltd. ; G. MacLellan & Co. ; Falk, Stadelmann and Co., Ltd.

Electric lamps, Schedule 64*a*.—Pope's Electric Lamp Co., Ltd.

BERMONDSEY.—The Electricity Committee has accepted the tenders of the Glenboig Union Fireclay Co., Ltd., for 1,650 fire bricks, and 1½ tons fireclay for £15 17s. 6d., and Babcock & Wilcox, Ltd., for arch plates, rails, driving links, noses, &c , for £15 16s. 6d.

POPLAR.—The B.C. has been recommended to accept the tender of Messrs. Economisers, Ltd., at £360, including the cost of erection, for renewing the tubes of the economiser at the refuse destructor.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co., Ltd., for coal for the electricity works for a year, at 13s. 4d. per ton.

Manchester.—The Electricity Committee has decided that Messrs. Ed. Bennis & Co., Ltd., shall carry out the work in connection with the supply, delivery and erection of four chain grate stokers for boilers Nos. 45 and 46, at Stuart Street generating station.

The contract of the Street Mains and Lighting Sub-Committee with the British Electric Transformer Co., Ltd., for air-cooled transformers has been extended to June 30th, 1916, with the addition of an extra size.

The Electricity Committee has accepted the following tenders :—

Cables.—B.I. & Helsby Cables, Ltd., and W. T. Glover & Co., Ltd.
Oil immersed transformers, 250 and 500 K.V.A.—Ferranti, Ltd.
Service boxes.—J. Stubbs, Ltd., and Hardy & Padmore, Ltd.
Tail end boxes.—B.I. & Helsby Cables, Ltd.
Carbon, metal-filament and Mazda lamps.—British Thomson-Houston Co., Ltd.
Radiator lamps.—General Electric Co., Ltd.
Radiator lamps (Dowsing).—Dowsing Radiant Heat Co., Ltd.
Rubber-insulated service cables.—Callender's Cable and Construction Co., Ltd.

Manchester.—The Education Committee has accepted the following tenders for work at the Baguley Sanatorium :—

Installation of electric light.—Bertram Thomas.
Metal-filament lamps.—Siemens Bros. Dynamo Works, Ltd.
Extensions to accumulator house, &c.—Robert Carlyle.

New Zealand.—WELLINGTON.—The Public Service Stores Tender Board has received the following tenders :—

60 MILES RUBBER-INSULATED TWIN TWISTED WIRE.

P. R. Baillie & Co.	(accepted)	£783
Turnbull & Jones		780
Lawrence & Hanson Electrical Co.		841
Richardson, McCabe & Co.		915
A. D. Riley & Co., Ltd.		1,028

8 MILES LEAD-COVERED CABLE, 26 PAIRS.

Lawrence & Hanson Electrical Co.,	(accepted)	£1,168
Richardson, McCabe & Co.		1,184
A. D. Riley & Co., Ltd.		1,192
P. R. Baillie & Co.		1,200
Turnbull & Jones, Ltd.		1,200
A. & T. Burt, Ltd.		1,240

6 MILES LEAD-COVERED CABLE, 39 PAIRS.

Lawrence & Hanson Electrical Co.	(accepted)	£1,134
Richardson, McCabe & Co., Ltd		1,146
A. D. Riley & Co.		1,146
P. R. Baillie & Co.		1,170
Turnbull & Jones, Ltd.		1,176
A. & T. Burt, Ltd.		1,254

7 MILES LEAD-COVERED CABLE, 52 PAIRS.

Turnbull & Jones, Ltd.	(accepted)	£1 694
Richardson, McCabe & Co.		1.724
A. D. Riley & Co., Ltd.		1.729
A. & T. Burt, Ltd.		1,785
P. R. Baillie & Co.		1.758
Lawrence & Hanson Electrical Co.		1,834

1½ MILES LEAD-COVERED CABLE, 104 PAIRS.

P. R. Baillie & Co.	(accepted)	£628
Richardson, McCabe & Co., Ltd.		6 0
A. D. Riley & Co., Ltd.		638
Turnbull & Jones, Ltd.		645
A. & T. Burt, Ltd.		658
Lawrence & Hanson Electrical Co		675

7 MILES 128 YARDS LEAD-COVERED CABLE, 208 PAIRS.

P. R. Baillie & Co.	(accepted)	£5,516
Richardson, McCabe & Co.		5,587
A. D. Riley & Co., Ltd.		5.601
Turnbull & Jones, Ltd.		5,658
A. & T. Burt, Ltd.		5.799
Lawrence & Hanson Electrical Co.		5,976

6 MILES 644 YARDS LEAD-COVERED CABLE, 312 PAIRS.

Richardson, McCabe & Co., Ltd.	(accepted)	£6,493
P. R. Baillie & Co.		6,556
A. D. Riley & Co.		6,569
Turnbull & Jones, Ltd.		6,684
A. & T. Burt, Ltd.		6,824
Lawrence & Hanson Electrical Co.		7,002

6 MILES 1,100 YARDS LEAD-COVERED CABLE, 416 PAIRS.

A. D. Riley & Co., Ltd.	(accepted)	£7,042
Richardson, McCabe & Co.		7,291
Turnbull & Jones, Ltd.		7,287
P. R. Baillie & Co.		7,948
Lawrence & Hanson Electrical Co.		7.618
A. & T. Burt, Ltd.		7,923

6½ MILES LEAD-COVERED CABLE, 520 PAIRS.

A. D. Riley & Co., Ltd.	(accepted)	£8,125
P. R. Baillie & Co.		8,418
Richardson, McCabe & Co., Ltd.		8,437
Turnbull & Jones, Ltd.		8,437
Lawrence & Hanson Electrical Co.		8,812
A. & T. Burt, Ltd.		9,293

7 MILES LEAD-COVERED CABLE, 624 PAIRS.

P. R. Baillie & Co.	(accepted)	£10,641
A. D. Riley & Co., Ltd.		10,752
Turnbull & Jones, Ltd.		11,025
Lawrence & Hanson Electrical Co.		11,550
A. & T. Burt, Ltd.		12,012

2 MILES LEAD-COVERED ARMOURED CABLE, 104 PAIRS.

P. R. Baillie & Co.	(accepted)	£1,183
Richardson, McCabe & Co.		1,190
A. D. Riley & Co., Ltd.		1,202
Turnbull & Jones, Ltd.		1,240
A. & T. Burt, Ltd.		1,254
Lawrence & Hanson Electrical Co.		1,280

9 MILES LEAD-COVERED ARMOURED CABLE, 312 PAIRS.

Turnbull & Jones, Ltd.	(accepted)	£11,790
Richardson, McCabe & Co., Ltd.		11,970
P. R. Baillie & Co.		12,064
A. D. Riley & Co., Ltd.		12,240
A. & T. Burt, Ltd.		12,402
Lawrence & Hanson Electrical Co.		12,780

1 MILE SILK AND COTTON-INSULATED SWITCHBOARD CABLE, 312 PAIRS.

A. D. Riley & Co., Ltd.	(accepted)	£1,385
Turnbull & Jones, Ltd.		1,400
P. R. Baillie & Co.		1,460
A. & T. Burt, Ltd.		1,831

1 MILE SILK AND COTTON-INSULATED SWITCHBOARD CABLE, 624 PAIRS.

Turnbull & Jones, Ltd.	(accepted)	£2,617
A. D. Riley & Co., Ltd.		2,648
P. R. Baillie & Co.		2,855
A. & T. Burt, Ltd.		3,649

6,000,000 LEAD SEALS, ⅜-IN. DISK.

Canterbury Engineering Co., Ltd.	(accepted)	£1,732
Hughes & Cossar		1,687
R. W. Cameron & Co.		1 737
P. R. Baillie & Co.		1,776
J. L. Lennard		1,818
W. H. Simms & Sons		1,912
J. McIlwraith & Co. Propy.		1,950
Millar & Young		2,275

100,000 CUPS INSULATOR, "SINCLAIR."

P. R. Baillie & Co.	(accepted)	£3,174*
A. M. Holmes		1,262
A. & T. Burt, Ltd.		1,814
Richardson, McCabe & Co.		1,866
Turnbull & Jones, Ltd.		1,896
A. D. Riley & Co , Ltd.		1,926
Butcher, Reed & Co., Ltd.		2,100

* Including volts.

100,000 BOLTS, INSULATOR, "SINCLAIR."

P. R. Baillie & Co.	(accepted)	£3,174*
Turnbull & Jones		1,486
A. & T. Burt, Ltd.		1,496
Richardson, McCabe & Co., Ltd.		1,533
Lawrence & Hanson Electrical Co.		1,537
Butcher, Reed & Co., Ltd.		1,750
A. D. Riley & Co., Ltd.		1,787

* Including cups.

—*New Zealand Shipping and Commerce.*

The Christchurch City Council has accepted the tender of Messrs. Lawrence & Hanson Electrical Co. for the supply of aerial cables for two years.

The Wellington City Council has accepted the following tenders :—

Insulated cable—P. R. Baillie & Co.
Gear wheels—Richardson, McCabe & Co.
Overhead material—P. R. Baillie & Co.

—*New Zealand Shipping and Commerce.*

Salford.—The Tramways Committee has accepted the tender of the Tudor Accumulator Co., Ltd., for welding about 550 tramway rail joints, at 27s. 6d. per joint. The offer of Messrs. W. T. Glover & Co., Ltd., to purchase low-tension cable has been accepted by the Electricity Committee as follows :—1·0 sq. in. cable, £845 15s. 6d. per mile ; 1·2 sq. in. cable, £1,010 per mile.

Southampton.—The T.C. has accepted an offer from Messrs. Bradbury, Son & Co., for 3,500 tons of Tamworth coal for the electricity works, at £1 2s. 10d. per ton.

Spenborough.—The Electricity Committee has accepted the tenders of Messrs. Wm Bennett & Sons and Messrs. W. H. Sharp and Sons for coal for the electricity and destructor works for one year.

Watford.—The U.D.C. E.L. Committee has accepted the offer of Messrs. Parsons to repair the rotor of an alternator, for £116 ; the Council has agreed to pay £40 towards the cost. The offer of Messrs. Cory & Co. to supply, during the next 12 months, 1,000 tons of Griff Peas, at 22s. per ton, has been also accepted. The Committee has accepted the prices of Messrs. W. T. Henley's Telegraph Works, Ltd., for the supply of cable. The British Westinghouse Co. has asked the Council to pay an increased price for the transformers recently ordered. The matter is to be favourably considered if the transformers are delivered within the specified time.

West Bromwich.—The Electricity Committee recommends the acceptance of the tender of Messrs. B.I. and Helsby Cables, Ltd., for the necessary extra-high-tension mains and extensions to switchgear, and that of Messrs. Ferranti, Ltd., for the extra-high-tension cubicle, in connection with the additional supply of current to Messrs. J. Brockhouse & Co., Ltd.

Winchester.—Messrs. Ferranti, Ltd., have been awarded the contract for prepayment electricity meters for the Corporation to May, 1916.

THE SCIENTIFIC ORGANISATION OF WAR MATERIAL SUPPLIES IN GERMANY AND INCIDENTAL —— ROBBERY.

BY R. STEYLAERS.

OFFICIAL documents published in the *Elektrotechnische Zeitschrift*, dated June 24th, which I give below are of exceptional interest in that they demonstrate a few facts, the gist of which I herewith enumerate :—

1. That as early as August 13th of last year, in the early stages of the war, Germany realised the necessity of organising all her national resources for the monopolisation of war supplies, a necessity which was only recognised by the Allies recently.

2. That the requisition or commandeering of all supplies in the occupied territories of Belgium and Poland was most carefully preconceived, and was, moreover, systematically executed, which is tantamount to robbery. The word robbery, by which I intentionally stigmatise the system, is justified by the fact that, although the Hague Conventions admit the right of the belligerents to requisition war material in occupied territory, they provide an equitable remuneration for such requisitions, whereas we Belgians, as well as the French and Poles, know that requisition bills delivered by the German troops remain up to the present to a large extent quite a negligible asset to the creditors, who have tried unsuccessfully to collect their face value. We know of merchants who received vouchers for such requisitions written in pencil on a scrap of paper torn out of a pocket note-book, and signed by one of their German competitors who requisitioned the goods under the threat of the bayonet.

3. That the specific designation in the official German organisation of definite kinds of war material, which were to be requisitioned by the German troop commanders, not only in Germany, but in the occupied territories, namely, metals of all kinds, jute, hemp, linen, thread, wool, and also *cotton*, besides a number of organic substances amongst which were fatty materials, proved to any ordinary layman the obvious necessity of counteracting such activities by stopping with the aid of all possible means the importation either directly or indirectly of such goods into Germany.

4. That it is clear and quite cynically stated in the organisation scheme reproduced below that Germany was giving all kinds of encouragement to contraband trade in neutral countries, and even maintained agents in Allied countries for the purpose of *utilising all possible means to import such raw materials from outside.*

This fact having been recognised, a counter-organisation should have been established on the same commercial bases to purchase all available material in competition with German agents abroad and transport them to Allied countries. This could be realised with much greater facility by the Allies, owing to their complete control of the markets and seas.

5. That the exploitation of natural resources in occupied territories was systematically carried out by specially formed limited companies, under German Government control, and, therefore, no one will be surprised to hear that Belgium and Northern France have been intentionally robbed by scientific plunderers.

6. With regard to raw materials which Germany has foreseen she might run short of, such as copper, the invaders have been taking for some time the necessary precautions to evolve substitutes. This is substantiated by the substitution of *iron* and *zinc* wire for the usual copper wires in electrical installations. As proof I quote the advertisements of cable manufacturers in Germany :—

"*Zinc Conductors with Rubber Insulation; Iron Flexible Wire; Iron Bare and Insulated Conductors; Iron Conductors Lead-sheathed.*

"HACKETHAL DRAHT UND KABEL WERKE A.G. HANOVER.

"Small stock is still available of Tube Cables with Copper Conductors. Ask for List of Stocks. Largest Diameters only.—Kabelwerk Duisburg."

This explains also why, in the early stages of the war, copper door-handles, bells, door-plates, &c., were removed to Germany, this naturally causing people to believe that Germany was running short of copper, whereas it was only a measure of precaution.

The present condition in Germany shows that the substitution of zinc or iron wire for copper wire or cable, in electrical installations, is being rendered daily more necessary to maintain the huge consumption of copper by monthly wastage of some 8,000,000 shells at least, the recuperation of which is only partly possible.

We may conclude that if the Allies take more care in future to stop contraband metals and other war requisites than has been the case hitherto, Germany cannot possibly continue much longer the expenditure of shells and explosives of which only 30 or 40 per cent. can be recovered from the expended shell cases, on a basis of 12,000 tons approximately, I calculate, of copper required monthly.

A huge effort has evidently been determined upon for the present months of July and August, by the accumulation of all possible natural resources, but once this effort has been spent (let us hope unsuccessfully), the provision of shells and munitions in Germany will suddenly become seriously depleted, with the possibility of their military efforts being brought to a standstill.

German Organisation of the Problem Concerning the Distribution of Raw Materials for the Purpose of War on behalf of the German War Office.

"When the war broke out our War Office had to face the problem of providing Germany with the requisite war material on the hypothesis of a long war. This was the origin of the creation on August 13th, 1914, of a division of the War Office for supplying raw material, the organisation and existence of which is described as follows by the *Norddeutsche Allgemeine Zeitung* :—

"The object of the Division for Supplying War Material concerns generally the obtaining and distributing of the seizable supplies necessary for the requirements of the Army. The seizures and requisitions afford the possibility to dispose of the raw materials and to prepare them for the purpose of the country's defence.

"In case the Government itself does not consume directly this raw material, its appropriate distribution must be made by private industry working on war requisites for the Army.

"The following questions are generally dealt with by the Division for supply of war raw material :—

"1. The limitation as far as possible of requisites used in peace time, the indication of the means to attain this purpose, and to replace such raw material.

"2. Experimenting with and employing new substances to replace raw material.—Recuperation of by-products.

"3. Producing artificial war material by the latest technical and chemical discoveries.

"4. Establishing, and in case of necessity financially supporting, new factories or increasing existing plants.

"5. Imposing the duty on the interested concerns not to do any trade in raw material, and to effect the same only for transformation in their own business.

"6. *The utilising of all possibilities to import such raw material from outside.*

"7. *The obtaining, transporting and distributing of all stocks existing in all occupied enemy territories by which the available stocks can be increased.*

"The division of the material has to be made according to orders from the military Government, taking into account the qualities required for each particular use or industry. The valuation of the seized or requisitioned goods is effected on the basis of prevailing market quotations in Germany. * *Too low quotations should be avoided in order not to discourage importation.* For a number of raw materials it has been necessary to fix maximum prices, as well as to create organisations, *in order to transfer some stocks from enemy country to the Fatherland*, to accumulate them in proper places, to distribute and to account for them.

"The distribution of raw material is sub-divided between collecting and administration Committees for the purpose of defining each

* This is offering a premium for contraband.

RAW MATERIAL SUPPLY DIVISION OF THE GERMAN WAR OFFICE.

Collection Committees.			*Professional Committees.*
General Division for the study of organisation and administrative questions.	Requisition Division for the execution of seizures and requisitions, Office of Statistics.	Forwarding Division for the execution of the forwarding orders, and for the institution of distribution and collection places.	For metals, chemicals, hides, leather, jute, flax, linen thread, rubber, wool, cotton, hemp, and a series of organic substances.

PRIVATE AND INDIVIDUAL ORGANISATIONS.

Raw material. Limited companies with Control Committees.	*Accounting Committees paying a Governmental survey tax.*	*Valuation and Distribution Committees and Accounting Departments.*	*General Raw Material Administration in Brussels.*
Kammwoll A.G. (Carded Wool, Ltd.)	Flax Committee		
Kriegswollbedarf A.G. (War Wool Requisites Co., Ltd.)	Jute "		
Kriegschemikalien A.G. (War Chemicals Co., Ltd.)	Rubber "		
Kriegsmetall A.G. (War Metal Co., Ltd.)	Cotton "		
Deutsche Rohhaut A.G. (German Rawhides Co., Ltd.)	Raw Cotton "		
Kriegsleder A.G. (War Leather Co., Ltd.)	Horsehair "		
Deutsche Holzvertriebs A.G. (German Timber Trade Co., Ltd.)	Wool Trade Association, Leipzig.		
A.G. für Verwertung von Stoffabfällen (limited company for recovery of by-products.)	German Hemp Manufacturers' Association.		
	Forwarding Association of war raw material companies		
	Linen Thread Committee.		

individual raw material territory, such Committees being somewhat like the head of the whole system. The immediate taking-over by the Government of all raw material alluded to, was hampered by serious drawbacks in practice. Therefore the necessary sub-organisations were established on private commercial bases, and the form of limited companies with their controlling committees was deemed particularly suitable. Such limited companies are organised on co-operative bases.

"The profits, however, are not paid out; the Government exercises its control by means of a Governmental commission possessing a right of veto.

"However, when a given industry comprises only a relatively small number of enterprises which are already affiliated to trust organisations, in such case instead of the above-mentioned limited company it is the Valuation Committee which exercises the control, for which a survey tax has to be paid by it to the Government.

"The working ground of these raw material companies comprises, therefore, the taking-over of all stocks or raw materials situated in their district, derived from the neutral resources of the country, or from the occupied territories; the payment of requisition bills; the obtaining of stocks from neutrals; the distribution of raw materials; the confirmation of purchase prices for requisitioned goods and their selling prices, it being understood that any profits made for co-operative purposes (instead of being paid out) once these companies will be liquidated.

"Quite independent of these raw material companies, to which they are adjoined, there are the valuation and distributing committees acting as intermediaries between the interested parties.

"The Valuation Committees have to fix the prices of seized or requisitioned goods for the stocks which have to be seized, in accordance with the German market quotations. The Distribution Committees have to distribute to the individual manufacturers the raw materials which have been sent to the accounting central committees. The obtaining and carrying away of the stocks existing in enemy country are in the charge of the administration of raw material in Brussels and of the commercial appropriation offices at each halting place of the troops.

"We submit herewith a general view of the sub-organisation of the war division for supply of raw material in the German War Office. This is, therefore, the complete scheme of the German organisation for war material."

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Friday, July 16th. At 10.30 a.m. At Institution of Civil Engineers, Great George Street, S.W. Seventh Annual Congress. Papers on "Glimpses into the Obvious," by Mr. A. V. Mason; "Tramways During War Time," by Mr. J. W. Dugdale; "Electric Battery Vehicles as Adjuncts to Tramways," by Mr. W. H. L. Watson. An informal dinner will be held in the evening at the Trocadero.

NOTES.

Late Legal.—NEW PHONOPORE TELEPHONE CO., LTD., *v.* ELECTRICAL SUPPLIES CO., LTD.—At the Westminster County Court, on Tuesday, before Judge Woodfall, plaintiffs claimed £95 damages from defendants, wholesale factors and agents, for detaining a portable telephone beyond a stipulated period.

Mr. G. C. Kingsbury, for the plaintiffs, said that they were manufacturers of various kinds of electrical instruments, including telephones, and they were the holders of various patents. In February last they were in treaty, through an agent in France, for the supply of a new portable field telephone to the French Army, and a sample of the telephone was in the hands of their carriers awaiting a permit for it to be taken to Paris. On February 26th one of the directors of the defendant company rang up the plaintiffs on the telephone, and asked whether they had a good telephone for sale. An affirmative reply was given, and the plaintiffs' managing director had an interview with one of the directors of the defendant company and explained the position, stating that the sample telephone should be obtained from the carriers and submitted to the defendants the following day if possible. Large supplies were spoken of, it being understood that about a hundred telephones a week might be required. On March 2nd, the sample telephone was obtained by the plaintiffs and handed over to the defendants on the understanding that it would be returned the following day. It was not so returned, however, and the defendants detained it until May 5th, thereby occasioning the plaintiffs very considerable loss, although they only claimed £95—£20 being the value of the telephone.

Mr. Charles Isaac, managing director of the plaintiff company, in giving evidence, said that when he first spoke to one of the directors on the telephone, the latter expressed a hope that the plaintiffs would be able to deliver to them at least 100 field telephones a week. When the sample was submitted, it was clearly stipulated that it must be returned on the following day, and the fact that this was not done had been a loss to the plaintiffs of a very considerable sum.

Cross-examined, Witness denied that the defendants said they desired to get the sample telephone in order to submit it for the approval of the French Government. Mr. Roden, the director of the defendant company with whom witness had the interview, told him that he wished to submit the sample to a customer in London, and would return it without fail on the following day.

Mr. A. H. Nicolson, engineer to the plaintiff company, said when he went to the defendant company to superintend a slight repair to the sample telephone, consequent on an accident, he heard Mr. Roden say that the telephone was to be returned the following day.

For the defence, Mr. Roden said that in the interview with Mr. Isaac, on March 2nd, he told him that the defendant company had received a large number of orders for field telephones, and Mr. Isaac seemed surprised at the magnitude of the orders mentioned, and asked if they were for any of our Allies. Witness replied that they were intended for the French Government.

Cross examined, Witness denied that he promised the return of the sample telephone on the day following the interview.

His Honour said he wished it had been left to a jury to decide whose memory could best be relied upon. The only issue was whether there was an agreement to return the sample telephone on the day after the interview on March 2nd, and he had come to the conclusion, after weighing all the evidence and correspondence, that there must be judgment for the plaintiffs. The sample telephone had, however, been returned to the plaintiffs by the defendants, and, under those circumstances, he gave judgment for the plaintiffs for 40*s.* and costs.

Judgment was entered accordingly.

CITY IMPORTING CO. *v.* DEFRIES & GOLDMAN.—In the Lord Mayor's Court, on Tuesday, before the Common Serjeant (Sir F. Bosanquet, K.C.) and a jury, a claim was made by plaintiffs, of Chiswell House, Finsbury Pavement, E.C., against Defries & Goldman, Ltd., 59 and 60, New Oxford Street, to recover £10 0*s.* 9*d.* for electric bulbs sold to the defendants.

Mr. Herbert Jacobs, counsel for the plaintiffs, said that on February 22nd electric bulbs were delivered to the defendants, pursuant to an order, amounting to the sum of £41 1*s.* 1*d.* Payment of the account was not made, and various applications produced no result. Ultimately the plaintiffs allowed the defendants to return 4,470 electric bulbs, the defendants retaining 1,350, probably because they had sold them, the price of which, according to the original contract, was 14*s.* 10½*d.* per 100, which worked out at the sum now sued for.

Mr. Rueben Segal, partner in the plaintiff firm, gave evidence of having received an order from the defendants for 5,820 electric bulbs. Of those the defendants had retained 1,350, the price of which was now sued for.

The Common Serjeant, in addressing the jury, said the electric lamps in question seemed to be a cheap lot, something less than 15*s.* per 100. But, he added: "I daresay it is as much as they are worth."

The jury returned a verdict for the plaintiffs, there being no appearance on behalf of the defendants, and upon the application of the plaintiffs' counsel the claim was amended to £10 0*s.* 9*d.*

Copper.—Messrs. H. R. Merton's fortnightly statistical circular shows a considerable increase in European visible supplies, the quantity for the end of March being 38,041 tons, an increase of 3,951 over that registered for the end of May. English supplies during the month have increased by 2,311 tons, and French by 2,240 tons. In detailed supplies we find that arrivals in Europe from North America have been exceptionally small, not reaching half the pre-war average. Spain and Portugal continue to send in an encouraging quantity, the amount exceeding the pre-war average by nearly one-half. Unclassified "other countries" also show up well with about one-third more than the pre-war average. Chile shipments were full on the month, but the destination of these is stated as "Europe and U.S.," which may, of course, mean that the U.S. have been taking the larger quantity. Australian shipments are low at 2,500 tons. Total deliveries for the month are low at 28,185 tons, though by no means the lowest for the year.

Electrical Convention at San Francisco.—Last month the Annual Convention of the National Electric Light Association of the United States was held at San Francisco, and was a highly successful event. Mr. E. W. Lloyd, of the Commonwealth Edison Co., of Chicago, was elected president for the new year. President H. H. Scott, remarking that the electricity companies were giving the public six times as much light for $1 as 15 years ago, while the consumers were requesting reductions in the price per KW.-hour, said that it brought home forcibly to them that the sale of energy on a "straight KW.-hour rate" was not equitable, but that in addition to a rate for energy they should have a demand charge and a fixed charge per customer.

The membership of the Association amounts to no less than 13,448, an increase of 431.

During the year 150,000 copies of the Association's *Bulletin* were issued, and the Publications Committee distributed nearly a million pieces of printed matter.

It was stated that returns from 100 towns of 5,000 inhabitants and under showed that 58 per cent. of the houses were wired; in towns of 5,000 to 10,000 inhabitants the proportion wired was 54 per cent., and between 10,000 and 20,000, 60 per cent. On the Pacific Coast the ratio was no less than 98 per cent.; the Atlantic Coast showed the lowest percentage.

The surplus of assets over liabilities was $34,247; the income for 1914 was $136,327, and the expenditure $122,811.

In an address Mr. Samuel Insull said the Association represented an industry with an annual gross income of more than £70,000,000 earned by central stations having a total rating above 8,250,000 H.P. of which one-third was derived from water-power. In 1914 110 million lamps were manufactured in the United States, out of a world production of 250 millions.

Educational.—The following awards have been made in the Faculty of Engineering at University College:—Archibald P. Head Medal and Prize, B. C. Drummond; Studentship in Heating and Ventilating Engineering, G. F. Mitchell.

Inquiries.—Makers of the "Pyrotite" fuses (centre contact, Edison screw) are asked for.

Electrical Opportunities in China.—China presents an exceptional opportunity now for American manufacturers of electrical machinery and appliances, according to Mr. J. H. Lee, electrical engineer and manager of the Lee Brothers Importing and Exporting Co., of Shanghai, China. Mr. Lee is a member of the Honorary Commercial Commission of the Republic of China, which is making a tour of the United States in the interest of closer trade relations between the two countries. In talking with a representative of the *Electrical World*, he outlined how the European war had affected the electrical supply business in China. For instance, his company formerly handled exclusively wire made in Austria. That source being shut off, and no other having developed, the price of the wire required to meet the Chinese demand has increased to nearly three times what it was at the beginning of the war. Many other electrical products have been affected similarly.

The previous inability or lack of desire of American electrical manufacturers to compete in price with European producers was mentioned by Mr. Lee. He also stated that American goods were usually of better quality than the Chinese market demanded. He considers that the price handicap has been overcome, perhaps permanently, by other conditions, and that manufacturers of the United States are evidencing a desire to meet the lower quality requirements of the Far Eastern trade.

Mr. Lee has made arrangements to represent several American manufacturers of electrical machinery, supplies and appliances in China. He also is negotiating with other concerns. It is his plan to supplant all his previous European accounts with American connections.

Trade with South America.—Mr. Calvert Townley, of the Westinghouse Electric and Manufacturing Co., recently made a tour through South America on behalf of his company's affairs, including every country in that continent except Paraguay, Ecuador and the Guianas. The trip lasted over six months.

On his return he told a representative of the *Electrical World* that in talking of the conditions existing on that continent it was easy to fall into the error of considering South America as a unit, whereas it was composed of many very distinct units where widely varying conditions prevailed. The various South America countries were as different from one another as Canada, the United States and Mexico. But all South American nations had established lines of activity—methods of doing business through channels which were satisfactory to them and which they were not anxious to change. It would be a serious mistake to think of South American markets, as many people seemed to do, as trees laden with ripe fruit waiting to be picked; rather were they more like fertile fields ready for the planting, but from which crops could be reaped only after a lapse of time and by careful and intelligent cultivation. Also at the present time the purchasing power of all the South American countries was considerably below normal owing to the fact that their revenues came largely from exports, and the markets for these had been curtailed tremendously. Europeans had cultivated the South American trade, they had established banking and shipping facilities, had invested their money in South American enterprises and had organised with varying degrees of thoroughness commercial campaigns to get South American business.

Those who believed that any of the European nations now at war would be permanently out of business in South America after peace was concluded, were liable to be very sadly mistaken. In the future they must expect to have to meet just as keen competition as in the past, and the interference with trade between South America and Europe caused by the war was only temporary.

Mr. Maurice Coster, export manager of the same company, said that the country need not look for any great improvement in trade with Central and South America until the European war had been brought to a close. The Central and South American countries, with the possible exceptions of the Argentine Republic and the United States of Colombia, were not in a position to finance new enterprises.

In order to ensure permanent success and an increase in export trade, the statutes relating to this subject must be revised. The Sherman Act should be amended in order to exclude from its provisions foreign business. Some of the foreign representatives acted in the capacity of "trade spies," and furnished their Governments with information concerning the business done by subjects of competing countries. They even went to the extent of supplying their Governments with detailed copies of invoices of American manufacturers made collectible through foreign banks.

The Government should adopt a definite policy favouring foreign trade, and the banks should be prepared to assist in financing Central and South American Governments and deserving enterprises in those countries, just as foreign banks had done for years with scarcely any losses. Foreign manufacturers have in the past investigated foreign enterprises, and, upon favourable report of the Government agent or other responsible party, have been able to secure the assistance of their banks in financing. The United States must not deceive itself by expecting that the war would so cripple European competitors as to make their competition negligible in the future.

Patents and Alien Enemies.—Application has been made to the Board of Trade for the avoidance or suspension of patents Nos. 21,027/03, granted to Hamilton, and 26,359/12 and 12,926/14, granted to Hamilton & Ferranti, Ltd., by Messrs. Ferranti, Ltd.

The application of Messrs. Babcock & Wilcox, Ltd., for the avoidance of Patents Nos. 27,516/11 and 19,696/12 has been abandoned.

Appointments Vacant.—Sub-station attendants for the period of the war for the Birmingham Corporation; improver for Hebden Bridge U.D.C. electricity works; meter superintendent (£2) for Beckenham U.D.C. See our advertisement pages to-day.

Technical Colleges and War Work.—Amongst the greatest difficulties that British instrument-makers have to contend with are the lack of skilled workmen and the scarcity of tools, such as bench lathes, &c., at a time when the national service demands the greatest possible output. In this connection a suggestion that we have received from Mr. R. W. Paul is worthy of consideration by the governors of technical colleges, who, we are sure, would gladly seize any opportunity to help on the nation's work. Mr. Paul points out that the holidays are approaching, when the staffs of the colleges—and the machines—will be liberated from their normal duties. The colleges usually employ at least one skilled mechanic each, and in some cases very expert instrument-makers, whose services during the vacation would be heartily welcomed by firms engaged on this class of work; the lathes and other small machine tools would also be most acceptable if loaned or hired to the manufacturers until the autumn. We commend this suggestion to the governing bodies of these public institutions, in the belief that they will be acting in accordance with their duty to the nation by adopting it; the skilled craftsmen must, of course, decide for themselves, but we feel sure that most of them will be only too glad of the opportunity to take part in war work. Mr. Paul will be pleased to make the necessary arrangements, and to put correspondents in touch with other instrument-making works if desired.

Metropolitan Association of Electric Tramway Managers.—Members of this Association accompanied by a number of friends visited Bournemouth on Wednesday of last week, where they were met on arrival by Mr. I. Bulfin, general manager of the Corporation Tramways. A special car conveyed the party to the Hotel Metropole, where an excellent luncheon was provided, and the comfort of the inner man having been satisfied, a motor char-à-banc tour through the most interesting and beautiful parts of Bournemouth, Poole and Christchurch occupied some three hours of the afternoon. On returning to the hotel, the party having taken tea, a move was made to the station, and at 7.11 the homeward journey began, dinner being served soon after leaving Bournemouth. Waterloo was reached at 10.30, and the visitors tired, but thoroughly pleased with their day out, separated for home, sweet home.

The hospitality of Mr. Bulfin was greatly appreciated by the company, which included many well-known and distinguished members of the electrical fraternity, and was eloquently acknowledged by one of them, and Mr. T. B. Goodyer, the popular, energetic and genial secretary of the Association, was simply ubiquitous, much of the success of the day being due to his untiring efforts from start to finish.

Volunteer Notes.—3rd. Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 8th, 1915:—

Week-End Parades.—Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m. "C" Company, under the command of Mr. C. F. Holland, will detrain at Wembley Park to take up a defensive position near the Remount Buildings, throw out Outposts, and watch the approaches from Edgware, Hendon and Neasden. When attacked, they will fall back on the Remount Depôt.

"A," "B" and "D" Companies, under the command of Mr. H. O. King, will detrain at Kilburn Station, and the Officer in command will make what arrangements he thinks fit to carry out the attack on the Remount Depôt at Wembley.

Bounds.—A line drawn from Preston to Edgware; the Edgware Road and Metropolitan Railway on the south. Captain Eastwood will act as umpire, and at the end of operations will send a report in to the Commandant. In the absence of Captain Eastwood, Mr. W. Ridd will perform this duty.

Sunday.—6 a.m., Reveille; 10 a.m., Church Parade; 10.20 p.m., Company and platoon drill; 2.30 p.m., battalion parade.

A. G. Joiner, *Captain and Adjutant.*

A Steam-Electric Dredge.—The Mambuloa Placer Co. has ordered from the New York Engineering Co. a gold dredge to operate in salt water in the Bay of Mambuloa, on the north shore of the Province of Ambos Camarines, Island of Luzon. According to the *Engineering and Mining Journal*, the machinery will be electrically driven, the electric power being generated on board by a steam turbo-generator. The dredge is designed to dig 55 ft. below water line and to stack 35 ft. above the water line. A high-pressure pump will furnish water for washing, being driven by a 125-H.P. motor, and a low-pressure pump will be operated by a 75-H.P. motor. Besides these, there will be fire pumps and the usual accessory pumps for the power plant. A travelling crane, separate stacker hoist and other modern equipment will be provided. It is stated that the total cost of the dredge when erected will be about $250,000.—*Financial Times*

Parliamentary.—ROYAL ASSENT.—The following Acts have received the Royal Assent:—Electric Lighting Orders Confirmation (No. 1) Act, 1915. Tramways Orders Confirmation Act, 1915.

Electrolytic Disinfectant.—In the course of his annual report on the working of the electrolytic plant at Poplar, mentioned in our last issue, Dr. F. W. Alexander, medical officer of health to the borough, states that the hypochlorite of magnesia solution is prepared by the electrolysis of water, containing certain definite proportions of sodium chloride and magnesium chloride. In spite of adverse criticisms, the process has been a success for eight years.

Hypochlorite of magnesium belongs to the magnesia and not to the alkali group; it is not caustic, is non-poisonous, and to the clothes is the least destructive of all the hypochlorites. It is obvious that the stable solutions of electrolytically-made hypochlorites of magnesium are preferable to those of sodium and potassium or even calcium, because for the purpose of rendering the three last-mentioned solutions stable there would have to be used hydroxide of the alkali metals or calcium, which are extremely caustic, alkaline, and very soluble, and where varying strengths of electrolytic fluid, containing the hypochlorites of sodium and potassium, are produced, one may add too much or too little of the hydroxides of the alkalis when working with unskilled labour. But when the extremely insoluble hydroxide or oxide of magnesium is added and mixed, one can add and stir in any quantity, but only the necessary amount will be absorbed.

I.M.E.A. Meeting: Electric Vehicle Discussion.—In referring to the remarks of Mr. Meaden, of Wolseley Motors, Ltd., in the electric vehicle discussion at the recent I.M.E.A. meeting, we inadvertently stated that his firm "made" instead of "supplied" both petrol and electric vehicles. It is, of course, well known that Wolseley Motors, Ltd., are introducing the Baker electric, an American production, to this country with the intention of finding out if there is a market and supplying it. Under the circumstances, the firm being large manufacturers of petrol vehicles, we may be permitted to hope that they will soon find it to their advantage to build the electric also.

Fatality.—While George Taylor, electrician to Messrs. William Baird & Co., Ltd., Muirkirk, was at work on one of the high arc lamps he fell from the platform to the ground, fracturing his skull and also receiving a severe scalp wound. He was removed to hospital in a serious condition.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Owing to the serious depletion of the electricity staff, the Bridlington T.C. has had to refuse MR. CROOKS leave to join the Forces.

MR. A. C. CRAMB, the borough electrical engineer of Croydon, has been nominated by the Board of Management of the Metropolitan Munitions Committee to serve as honorary district manager of the Croydon area.

MR. F. WHITEHEAD, shift engineer in the Accrington Corporation electricity department has resigned, and MR. A. GOWARD, of Oswaldtwistle, has been appointed to fill the vacancy.

MR. C. NEWTON RUSSELL, the borough electrical engineer of Shoreditch, has been appointed by the Metropolitan Munitions Committee to be manager of the Eastern District of London.

MR. FERGUSON, temporary engineer-in-charge at the Bermondsey electricity works, has resigned his appointment. MR. SPARROW, switchboard attendant, is in future to be paid 38s. instead of 32s. per week, while taking a shift.

MR. G. W. LEEDER, of Runcorn, has been appointed shift engineer at Eccles, in place of MR. A. HELLIWELL (resigned).

MR. E. J. JARVIS, of Devonport electricity works, has been granted a commission as second-lieutenant in the Hampshire (Fortress) Royal Engineers.

The West Hartlepool Town Council on Tuesday night appointed MR. J. W. SPARK, electrical engineer and manager to the County Boroughs of the Plymouth, Devonport and Stonehouse area, as its borough electrical engineer, at £400 per annum.

Tramway Officials.—MR. STANLEY KETTLE has resigned his position as chief assistant to the Musselburgh and District Electric Light and Traction Co., and has been appointed assistant engineer and depôt superintendent to the Sunderland District Electric Tramway Co., Ltd. Before going to Musselburgh he was for three years assistant engineer for the Ayr Corporation Tramways.

The Derby T.C. has appointed MR. GILBERT MANN, of Birkenhead, as car-shed superintendent at the Osmaston Road tramway department, at £150 a year.

MR. C. J. SPENCER, general manager of the Bradford City Tramways, has been appointed a transport officer on the Headquarters' Staff of the Bradford City Volunteer Force. Mr. Spencer holds the rank of Platoon Commander.

The Maidstone T.C. has increased the salary of the tramway manager, MR. LAMBERT, by £25 a year, as from July 1st.

General.—MR. J. SHEPHERD, as previously mentioned in this column, is terminating his engagement with the London County Council to continue the practice of consulting engineer carried on during the past 24 years by Mr. T. S. Watney, at Leeds, under the name of Shepherd & Watney. For 15 years Mr. Shepherd held responsible positions with leading manufacturing companies, turning out practically every type of electrical and other plant, and for the past 13 years he has been with the London County Council tramway department; for eight years he was chief assistant electrical engineer, and since 1910 he has had entire charge of the electrical work of the undertaking. The capital value of the plant directly in his care was £2,340,000, with an annual output of 150,000,000 units, which is larger than that of any other municipal undertaking in the world. He has also assisted in the preparation of the various bulk electric supply schemes for Greater London. Naturally, Mr. Shepherd has had a wide and varied experience in connection with nearly every type of engineering plant, and his numerous friends will join with us in wishing him every success in his new sphere of work. We understand that Mr. Watney will continue his interest in the practice in an advisory capacity.

Among the naturalisation notices in the *London Gazette* we observe the following:—JENS ORTEN-BOVING (Sweden), civil engineer, Ingatestone, Essex, oath of allegiance dated May 28th.

MR. H. T. MATTHEW has been appointed Pacific Coast representative for the Society for Electrical Development. For six years Mr. Matthew acted in the capacity of business manager of *Electrotechnical Industry* (now *Metallurgical and Chemical Engineering*), after which he was transferred to the Chicago office of the McGraw Publishing Co., as western manager for the *Electrical World*. For the past three years he has represented the McGraw publications on the Pacific Coast.

A wedding has been arranged and will take place quietly at St. Margaret's Church, Westminster, on July 21st, at 2 p.m., between MR. HORACE BOOT, consulting engineer, M.I.Mech E., M.I.E.E., Past President, Inst. Municipal Engineers (borough electrical engineer of Tunbridge Wells from 1895 to 1910), and Mabel, daughter of Thomas Baker, Esq., of Holt. Owing to the war there will be no reception, but all friends will be heartily welcome at the ceremony.

The managers of the Royal Institution have re-elected SIR JAMES DEWAR, F.R.S., Fullerian Professor of Chemistry for a period of three years.

MR. W. BROOKS SAYERS, who has until recently been engaged as milling machinist at the Royal Aircraft Factory at Farnborough, and is experienced in electric motor drives for machine tools, is relinquishing that work and opening an office at 27 and 28, Great Russell Street, London, W.C., where he will take up initiatory and instruction work.

A large gathering of Freemasons assembled at the Great Eastern Hotel, on Thursday last week, on the occasion of the Installation Festival of the Rolling Lodge, when MR. J. W. BULLEY (London manager to Messrs. Accles & Pollock, Ltd., of Oldbury) was installed in the chair for the ensuing year. Among the visitors were several Grand Lodge officers. The party dined together in the Norfolk Room. Mr. Bulley announced that it was his intention to go up to the next Boys' Festival as a steward, and sums amounting to 30 guineas gave the matter a good send off. Mr. Barlow, director of Accles & Pollock, Ltd., in replying for the visitors, announced that the directors had subscribed £5 5s. as a memento of the occasion.

Roll of Honour.—Among the announcements of appointments of officers to be Companions of the Distinguished Service Order are the following:—

Lieut. VYVIAN AUGUSTINE CAIRNS-CLEARY, 4th Signal Co., R.E., "for great gallantry in personally superintending the laying of the telephone lines every night over a large area of country which was continually shelled. It was due to his personal exertions and example during the period of April 27th to May 3rd, 1915, that the communications with the brigade were kept up so well."

Major WILLIAM FREDERICK MAXWELL, R.E. (attd. Lahore Divl. Signal Coy.).—"Near Ypres during the operations from April 24th to May 4th, 1915, he rendered excellent service when responsible for maintaining the signalling communications of the division, under most trying circumstances. The work was very heavy, and he also had to direct the constant repair of lines cut by the continuous heavy fire. This officer has done consistently well throughout the campaign."

Sec. Lieut. HENRY MORRANT STANFORD, 32nd Batt. R.F.A., "for consistently gallant conduct both at Neuve Chapelle and again on May 9th, 1915, during operations near Rouges Bancs, in keeping up communication by mending telephone wires under heavy fire."

The Chesterfield Corporation electricity works have suffered a great loss owing to the death of MR. T. E. BENNETT, second assistant engineer, who was shot in the trenches at the Front on Wednesday last week. Mr. Bennett, who was 33 years of age, had been with the Corporation for nearly 10 years, and he, with several other members of the staff, joined the 6th Notts. and Derbys in November last, and proceeded to the Front in February. This is the first death amongst the large number of the Chesterfield lighting and tramway staff who are serving their country in various branches of H.M. Forces, and great sympathy is felt with Mr. Bennett's family, who reside in Nottingham.

Sergeant FREDERICK J. FULLER, of the Royal Engineers, one of the charge engineers at Beckenham U.D.C. electricity works, was mentioned by General French in his last report for Distinguished Service in the Field.

Poignant interest attaches to the award of the D.C.M. to Lance-Corporal BEAGIN, of the 1/7th Worcesters, T.F., who before the war was an electrician employed by Messrs. Whittaker, of Dudley. Beagin secured the distinction near Le Gheer, on April 19th, when the telephone wire, having been cut at an isolated post, which the

enemy was shelling, Beagin at once voluntarily proceeded 100 yards across an open space, under shell and rifle fire, and connected up the post again with a spare instrument. Before the announcement of the award, Beagin's death through wounds was officially reported.

Private Harold Kay, 1/6th Manchester Regiment, who has died from wounds received in action in the Dardanelles, was the only son of Mr. T. C. Kay, secretary to Browett & Lindley, Ltd., engineers, of Patricroft, with whom he was being trained. He had previously been with the British Westinghouse Electric and Manufacturing Co., Ltd., and Dick, Kerr, & Co., Ltd., of Preston. He was 21 years of age, joined the Territorials on the outbreak of war, and was drafted to Egypt three weeks later.

Mr. F. G. Sands, formerly engaged at the Ilford U.D.C. electricity works, has been killed in action in the Dardanelles.

Private A. L. Hopton, of the Liverpool Scottish, who was an apprentice at the Corporation electricity works at St. Helens, has been wounded by a shell in France, and is in hospital at Rouen recovering. He joined last September, and went to the Front in January.

Private John Craig Burke, of Oldham, who is reported to have died of wounds received in action, was 23 years of age, and was in the employ of Messrs. J. P. Hall & Co., electrical engineers, Werneth, Oldham.

Private W. H. Nixon, R.M.L.I., Portsmouth Battalion, was killed in action in the Dardanelles, on May 3rd. He was formerly assistant electrician at Messrs. Cochrane's Stanghou mines.

The *Times* states that Lieutenant Hugh Bouchier Phillimore, A.M.I.C.E, 8th Argyll and Sutherland Highlanders (T.F.), who was wounded on June 15th in France and died the same day, was educated at Haileybury, and took up engineering and science, gaining the Whitworth Exhibition. He was for a time in the F.M.S. Civil Service, and more lately engaged in metallurgical work at Kinlochleven, Argyllshire. He received his commission in November, 1913, and after the outbreak of war volunteered for foreign service, and accompanied his battalion as machine-gun officer

Obituary.—The death occurred last week of Captain Halsall Owen, of Burfield, Appleton, Cheshire. Deceased was educated at Liverpool College, and began his business career with the Horseshay Bridge Building Co., of Shropshire, and later was engaged at the electrical works of Messrs. P. R. Jackson, Manchester. Subsequently he joined the firm of Monks, Hall & Co., Warrington, and was appointed secretary and engineer; and in 1911 he was appointed engineer to the Frodingham (Lincolnshire) Steel and Iron Co. Following severe illness in the same year, he retired. He had had long service with the old Volunteers and with the Territorials, and he offered his services to his country upon the outbreak of war, but failed to pass the medical test. He was in his 35th year.

At the funeral of the late Mr. C. E. Spagnoletti, Honorary Member and Past President of the Institution of Electrical Engineers, which took place at West Hampstead Cemetery last Friday, July 2nd, the Institution was represented by Sir John Snell (President), Prof. Carey Foster, F.R.S., Dr. S. P. Thompson, F.R.S., Mr. J. E. Kingsbury, Mr. Roger T. Smith, Mr. H. Hirst, and Mr. P. F. Rowell (secretary).

Mr. Ernest Long, electrical engineer, late of Newcastle-on-Tyne, died at Scotton Grange, Knaresborough, on July 3rd.

NEW COMPANIES REGISTERED.

Siluminite Insulator Co., Ltd. (140,804).—This company was registered on June 28th, with a capital of £1,500 in £1 shares, to acquire and turn to account any invention relating to the manufacture, production, treatment, application, recovery, distribution and use of electric insulating materials of all kinds, etc., and to adopt an agreement with W. E. W. Richards. The subscribers are: E. Spencer, 10, St. James's Place, S.W., barrister, 550 shares; W. E. W. Richards, 133-6, High Holborn, W.C., consulting engineer, one share. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Qualification, £50. Solicitors: Beckingsale & Co., 34, Copthall Avenue, E.C.

Cahirciveen Electric Light and Power Co., Ltd. (4,259).—This company was registered in Dublin on June 29th, with a capital of £1,800 in £1 shares, to carry on at Cahirciveen, Co. Kerry, the business of an electric light supply company in all its branches. The subscribers are: Rev. P. Browne, Cahirciveen, 100 shares; T. Ryan, Cahirciveen, merchant, 50 shares; Miss J. A. O'Sullivan, Cahirciveen, 30 shares; Rev. T. D. O'Sullivan, Cahirciveen, 25 shares; W. J. Leslie, J.P., Cahirciveen, 25 shares; J. F. Mannia, F.R.C.S., Cahirciveen, 20 shares; T. Sugrice, Cahirciveen, merchant, 15 shares. The number of directors is not to be less than three or more than six; the first are T. B. Morley, J. Brenhan, T. C. Fitzgerald, M. J. Healey, P. J. Reardon, and E. L. Cantwell. Qualification, £25. Registered office: Power House, Cahirciveen.

Bachelet French Syndicate, Ltd. (140,823).—Registered June 30th, by Wake, Wild & Boult, 158, Aldersgate Street, E.C. Capital £50,000 in £1 shares. Objects: To adopt an agreement with H. G. Barrett to acquire and turn to account patents, licences and rights, to carry on the business of manufacturers of and dealers in any articles capable of being manufactured thereunder, and that of founders, tool makers, metal workers, boiler makers, electricians, electrical, mechanical, and general engineers, generators and storers of electricity, etc. The signatories (with one share each) are: W. E. Newell, 166, Piccadilly, W., secretary; J. S. Murray, 166, Piccadilly, W., gent. Private company. The first directors (to number not less than two or more than seven) are C. Vane (chairman), 166, Piccadilly, W.; H. G. Barrett, Mill Lane, Clayton, Sussex; D. S. Crowther, Hay Green, Kingston Hill, Surrey; T. B. Burnham, Woodhurst, Crawley; A. Dent, 55, Lee Park, Blackheath, S.E.; and E. Alderton, 42, Piccadilly, W. Qualification, £5. Remuneration, 10 per cent. of the profits available for distribution for dividend, divisible. Registered office: 166, Piccadilly, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Sherardizers, Ltd.—Debenture, dated June 10th, 1915, to secure £600, charged on company's property, present and future, including uncalled capital. Holder: W. J. Halsey, 23, Queen Anne's Gate, S.W.

Carville Site and Power Co., Ltd.—Issue, on June 18th, 1915, of £10,000 debentures, part of a series of which particulars have already been filed.

Vactite Wire Co., Ltd. (105,696).—Capital, £450 in £1 shares. Return dated December 31st, 1914 (filed May 27th, 1915). All shares taken up; £2 paid; £448 considered as paid. Mortgages and charges, £1,700.

Van Raden and Co., Ltd. (78,383).—Capital, £10,000 in £1 shares. Return dated January 14th (filed May 8th), 1915. 6,754 shares taken up; £1 per share called up on 4,654 shares; £4,654 paid; £2,100 considered as paid on 2,100 shares. Mortgages and charges, £4,600.

North Metropolitan Electrical Power Distribution Co., Ltd.—Particulars of £25,000 debentures, created by resolutions of June 17th, 1909, and May 6th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

General Cable Manufacturing Co., Ltd.—Debenture, dated June 24th, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders, Aubert Grenier & Co., Cossony-Gare, Switzerland.

Oxford Electric Co., Ltd. (34,685).—Capital, £175,000 in £5 shares (15,000 pref.). Return dated March 19th, 1915. 20,000 ord. and 11,000 pref. shares taken up; £5 per share called up on 13,200 ord. and 10,000 pref., and £1 per share on 1,000 pref. shares; £118,550 paid (including £1,550 paid on 310 ord. shares forfeited); £34,000 considered as paid on 6,800 shares. Mortgages and charges, £50,000.

Nalder Bros. and Thompson, Ltd. (62,214).—Capital, £22,500 in £1 shares (10,000 pref.). Return dated December 10th, 1914. 9,461 pref. and 11,370 ord. shares taken up; £1 per share called up on 9,461 pref. and 1,370 ord.; £10,831 paid; £10,000 considered as paid on 10,000 ord. shares. Mortgages and charges, nil. Return of allotments made up to April 24th, 1915, shows a further 539 pref. and 161 ord. shares allotted for cash.

Oldham, Ashton and Hyde Electric Tramway, Ltd. (55,318).—Capital, £100,000 in £1 shares (50,000 pref.). Return dated April 5th, 1915. All shares taken up; £100,000 paid. Mortgages and charges, £47,000.

Northwood Electric Light and Power Co., Ltd. (66,312).—Capital, £30,000 in £1 shares (15,000 pref.). Return dated March 18th, 1915. 12,507 ord. and 6,880 pref. shares taken up; £1 per share called up on 8,282 ord. and 6,880 pref. shares; £15,162 paid; £4,225 considered as paid on 4,225 ord. shares. Mortgages and charges, £4,625.

Vera Cruz Telephone Construction Co., Ltd. (107,144).—Capital, £10,000 in £1 shares. Return dated February 1st, 1915. 9,655 shares taken up; £2,500 paid; £7,155 considered as paid. Mortgages and charges, nil.

West Naples Tramways and Valfortore Railway Co., Ltd. (107,436).—Capital, £50,000 in £1 shares. Return dated December 31st, 1914 (filed May 27th, 1915). 7,920 shares taken up; £1 per share called up on 920; £713 12s. 6d. paid, leaving £206 7s. 6d. in arrears; £7,000 considered as paid on 7,000 shares. Mortgages and charges, nil.

London Electrical Trading Co., Ltd.—Particulars of £3,000 debs., created March 16th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Brilliant Arc Lamp and Engineering Co., Ltd.—Second deb. dated June 23rd, 1915, to secure £90, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: S. H. Cohen, 4, Grosvenor Gardens, Willesden Green, N.W., and M. Nordwald, 125, Brondesbury Road, N.W.

Brook, Hirst and Co., Ltd. (95,264).—Capital, £20,000 in £1 shares. Return dated January 14th (filed May 14th, 1915). 12,500 shares taken up; £12,500 considered as paid. Mortgages and charges, £7,000.

Gell Telegraphic Appliances Syndicate, Ltd. (78,405).—Return dated March 12th, 1915. Capital at date of return, £40,000 in £1 shares. 37,700 shares taken up; 10s. per share called up on 15,000 and £1 per share on 7,700 shares; £15,537 10s. paid (including £337 10s. paid on 1,500 shares forfeited); £22,500 considered as paid, being £1 per share on 15,000 and 10s. per share on 15,000. Mortgages and charges, £1,000. The capital was reduced to £20,000 in 10s. shares on May 25th, 1915.

Carbone Arc Lamp Syndicate, Ltd. (80,279).—Capital, £9,880 in £1 shares (9,500 ord. and 190 "A" def. and 190 "B" def.). Return dated December 31st, 1914 (filed May 5th, 1915). 7,607 ord., 190 "A" def., and 190 "B" def. shares taken up; £1 per share called up on 107 ord. shares; £107 paid; £7,880 considered as paid on 7,500 ord., 190 "A" def., and 190 "B" def. Mortgages and charges, nil.

Cable Accessories Co., Ltd. (93,345).—Capital, £20,000 in £1 shares (4,000 6 per cent. cum. pref.). Return dated May 20th, 1915. 10,500 ord. and 1,800 pref. shares taken up; £1 per share called up on 8,042 ord., 15s. per share on 348 ord., 12s. 6d. on 1,910 ord., 10s. on 200 ord., and £1 on 1,800 pref.; £8,346 15s. paid; £3,050 considered as paid. Mortgages and charges, nil. Return of allotments made up to May 28th, 1915, shows a further 50 pref. and 5,500 ord. shares allotted for cash.

CITY NOTES.

Bombay Electric Supply and Tramways Co., Ltd.

The total revenue from all sources for the year ended December 31st, 1914, including the amount represented by sale of current to the tramways, amounted to £302,570, an increase of £26,102, or 9.44 per cent. The total expenditure was £144,987, an increase of £14,091, or 10.77 per cent. The net profit aggregated £157,583, an increase of £12,010, equivalent to 8.25 per cent. Interest on loans amounted to £1,907, interest on debenture debt £35,668, sinking fund account £6,732, depreciation fund account £27,000, redemption of second debentures of equivalent par value £8,000, contribution to officers' and employés' provident fund £2,303. After making these deductions and adding £4,350 brought forward, £80,322 remains, out of which the dividend on the 6 per cent. cumula-

tive preference shares absorbs £35,995, and a dividend on the ordinary shares of 6 per cent. per annum, free from English income tax, £36,000, leaving £8,327 to be carried forward. The gross tramway receipts were £169,885, compared with £170,672 for 1913, and the working expenses were £85,297, against £81,123. The balance of receipts over expenses is £84,588, compared with £89,549.

Up to the end of July, 1914, the traffic continued to show a progressive expansion. With the declaration of war in Europe the earnings commenced to decline in consequence of the shrinkage of the city's export and import trade resulting therefrom, and the general commercial depression. By the end of the year the net earnings from the traction branch of the business showed a decline of £4,900. Since the commencement of the present year there has been some recovery. For November last year the falling off in receipts had increased to 10.31 per cent. as compared with November, 1913. For March, 1915, the percentage of declension had fallen to 6.16 per cent. The future course of the tramway receipts was likely to depend largely upon the course of the war. The recent recovery in the prosperity of the mill industry at Bombay constituted an encouraging factor, but both the export and import statistics of the port continued to record a heavy decline. In view of the existing situation certain extensions of the tramway in contemplation before the outbreak of war have been deferred.

	1913.	1914.
Miles opened—Route miles	20.38	20.38
Passengers carried	40,692,022	40,449,634
Proportion of expenses to receipts	48 p.c.	51 p.c.
Cars in stock—		
(a) Running singly	150	150
(b) Coupled as two-car trains	60	80

The gross electric supply revenue, including the sale of current to the tramways, aggregates £132,669, compared with £105,466. The working expenses were £55,734, against £46,284. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amounted to £105,778, compared with £77,569 for 1913. The balance of £76,935 compares with £59,182 for 1913.

The progress of the supply branch continues satisfactory, the net revenue increase of £17,700 having considerably more than wiped out the declension in the net earnings from the traction branch, and recording a substantial advance on the percentage of increase in the net earnings from supply for 1913 as compared with 1912. Progressive as are the figures for 1914, they would have been even better but for the adverse influence of the war during the latter half of the year, which in various ways operated to check consumption.

The directors are continuing the policy of extending the supply mains where the demand justifies them in doing so. Apart from the domestic demand for lighting and fans, the industrial demand for electric energy for power purposes continues to record a marked progression. Amongst the more important contracts recently entered into under this heading are agreements with the British India Steam Navigation Co. and with Messrs. Alcock, Ashdown & Co.

The capital expenditure during the year was £46,461, principally for mains extensions and additional sub-stations and rolling stock. The report also describes the steps taken in connection with the increase of the capital of the company. After the re-opening of the Stock Exchanges an extraordinary general meeting of shareholders was held at which an issue of 12,000 additional ordinary shares of £10 each was authorised. The shares were offered to the shareholders, both preference and ordinary, at £12 12s. per share, in the proportion of 1 share to 10 shares of their individual holdings. As the result of this offer, 9,520 shares were subscribed.

Annual meeting: July 29th.

Crompton & Co., Ltd.

MR. CARLETON FOWELL TUFNELL took the chair at the annual meeting, held at Salisbury House, on Monday. He said he had again to congratulate the shareholders on the improved position of the company, for he thought they would all agree that the figures laid before them that day were satisfactory. The outbreak of war in August naturally had a detrimental effect on the business. A large number of employés joined the Colours, and the work in hand had to be completed under difficulties and at an increased cost. The company usually had a considerable amount of work in hand for Government departments, and although the value of such work completed and delivered in the period under review was in excess of that usually turned out, the orders from private customers were delayed. He mentioned this because it had been suggested that the increased profits of the company were due to the war, but as a matter of fact, if it had not been for the war the profits would have been better. The net profit was £26,460, as compared with £13,551 in the previous year, and with the amount brought forward they had £28,649 at their disposal. They proposed to place £6,500 to the general reserve fund, as against £2,500 last year. A sum of £3,500 was placed to special depreciation account; £1,608 was being written off preliminary expenses; and the full preference dividend of 7 per cent. was being paid, which would absorb £9,349, and leave £7,691 to be carried forward, as against £2,189. Some of the shareholders might feel a little disappointed that they did not recommend a dividend on the ordinary shares, but their policy of strengthening the company's position would, he was satisfied, receive their approval, for the events of the past year had more than ever convinced the directors of the necessity and value of this conservative policy. With regard to the balance sheet, the expenditure during the year was £12,749, most of which was for additional plant at the works. Stock in trade and work in progress—£196,757—was up by some £10,000. Investments in other companies remained at the same figure: the interest received on these investments was approximately 5 per cent. on the book values. With regard to the profit and loss account, the depreciation had been charged at the usual rate, for all repairs and maintenance had been debited against revenue. So far as the current year was concerned, the volume of orders in hand was satisfactory, and unless something unforeseen occurred to interfere with their working, they were looking forward to a successful year. During the year application was made to the Stock Exchange Committee for a quotation of the company's shares, but the Committee in their wisdom decided to postpone granting it until such time as the existing debentures—which were the original debentures of the old company—had been dealt with. Whilst the war lasted, nothing could be done. The board made suitable allowances for the dependents of their employés who had joined the Colours. In conclusion, the CHAIRMAN thanked the management and all concerned for the excellent work they had done in the past year.

Lieut.-Col. J. CLIBBOURN seconded the motion, and the report was adopted without discussion.

A hearty vote of thanks was passed to the board and staff for the way in which they had looked after the company's interests during an anxious period.

German Electrical Companies.

The Welter Elektrizitats und Hebe Werke, of Cologne-Zollstock report that the working results in 1914 were prejudicially affected by the war and by a serious fire. Although gross profits of £7,100 were earned as against £11,000 in 1913, the turnover for the year shows a slight loss, which has been extinguished by drawing upon the reserve fund. This situation compares with a dividend of 6 per cent. in 1913.

The accounts of the *Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremburg*, after placing £66,000 to reserve funds for renewals and redemption of the capital of the company's own supply works and allocating £2,600 to the general reserve fund, as against £5,000 in 1913, indicate net profits of £57,000 for 1914, as compared with £100,000 in the preceding year. It is intended to pay a dividend of 3½ per cent. on the preference capital, of which the capital almost entirely consists apart from loans, as contrasted with 6 per cent. in 1913.

The A.E.G. Schnellbahn Gesellschaft, of Berlin, which was formed at the beginning of 1914 by the A.E.G. and the Berlin Electricity Works Co. for the purpose of carrying into effect the agreement entered into in 1912 by the A.E.G. for the construction of an elevated and underground electric railway between Gesundbrunnen and Neukolln, has now presented its first report. It states that work on the first section in the Brunnen Strasse of a length of nearly one mile was commenced in May, and the second section which concerns the tunnelling of the Spree was begun in the autumn. Since the outbreak of the war the works have progressed more slowly than was foreseen, owing to the scarcity of labour and transport wagons, although the hope is expressed that the railway will be completed within the stipulated period. The paid up ordinary capital amounts to £1,000,000, and the preference shares to £1,125,000, interest on which is being paid during construction at the rate of 4½ per cent. and 5 per cent. respectively.

The report of the *Elektrizitats Gesellschaft, late W. Lahmeyer & Co., of Frankfort-on-Main*, which is a holding company belonging to the A.E.G. group, states that the effects of the war were perceptible all round, although these were manifested less in a decline in profits than in the necessity for the subsidiary companies to refrain from increasing their dividends. So far it has been possible to maintain uninterrupted working of the undertakings managed by the company in the country. The foreign undertakings principally concerned are the Kief-Swjatoschin tramway and the Warsaw Electricity Co. The former was sequestrated by the Russian Government in January, whilst the latter, whose administration is located in Paris, realised a greater surplus down to the outbreak of the war, but since that time it has been impossible to obtain further information. The accounts of the Continental Co. indicate gross profits of £197,000, as against £184,000 in 1913, and net profits of £103,000, as compared with £100,000. It is proposed to distribute 7 per cent. on the ordinary capital of £1,312,000, being the same rate as in 1913.

The directors of the *Akkumulatoren Fabrik A.G., of Berlin*, which owns the Tudor battery patents, state in their report for 1914 that as the year includes a period of war-time, they refrain from giving a review of the course of the undertaking in the home and export trade. During the early months of the war, a serious diminution in the turnover took place, but an improvement was noticed in each succeeding month, with the result that the total value of the deliveries for the year reached £1,011,000, as compared with £1,104,000 in 1913. It was impossible to say anything regarding the foreign undertakings as the conditions, even in neutral countries, did not permit of any sound opinion being formed. The gross receipts amounted to £436,000, as against £425,000 in 1913. After defraying general expenses and cost of management, and setting aside £29,000 for depreciation, as compared with £15,000, the net profits and balance forward are returned at £148,000, as contrasted with £147,000, and a dividend is proposed at the rate of 18 per cent. on the ordinary share capital of £600,000, as against 20 per cent. in 1913 and 25 per cent. in 1912.

Consolidated Electrical Co., Ltd.

The ordinary income for the year ended March 31st, 1915, amounted to £5,344, in comparison with £4,786 for the previous year. The general charges amounted to £1,191, in comparison with £1,220. Of the balance of £7,169 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1915, absorbed £450, leaving a disposable balance of £6,719. The final dividend of 3 per cent. payable on the preference shares will absorb a further £450, and the directors now recommend a dividend on the ordinary shares of 3 per cent. for the year, leaving £2,969 to be carried forward. The investments are, as on former occasions, taken in the balance sheet at cost; and, on the whole, have suffered little in comparison with the general shrinkage in market values since the outbreak of war. The scheme of arrangement referred to at the last general meeting, which it was intended to bring forward in the autumn of last year, could not be proceeded with in consequence of the disturbed financial conditions following upon the outbreak of war.

Mr. Herbert Allen presided over the annual meeting, held at River Plate House, E.C., on Tuesday. He said that on the face of the accounts there was little to indicate that the year under review embraced eight months of a devastating war—a war which had devastated the fields of finance almost as much as the battlefields of Europe. As a matter of fact, during a year of financial disturbance the assets of the company had suffered little, if any, depreciation. Their income showed a substantial improvement upon that of the previous year, and their expenses once more showed a decrease and had established a fresh record. They recommended the payment of a dividend of 3 per cent. on the ordinary shares, which would absorb £3,300 and leave £2,969, which, under the circumstances, the board thought it wise to carry forward. He did not think the board need offer any apology for the slight reduction in the dividend, but, on the contrary, they were almost entitled to congratulate themselves on being in a position to make a distribution of 3 per cent. at a time when well-managed companies of great magnitude and importance had had to drop the payment of dividends altogether. The policy of the board had been to keep the assets as liquid as possible consistently with the need of earning a reasonable return on the money to pay a dividend. On the whole, they could claim to have been fairly successful in this respect. At the outbreak of the war, which was at the time when the reorganisation scheme was to have been brought forward, their assets were divided pretty evenly between short loans and short-term investments. The average yield on the loans was quite satisfactory, and not a penny of the capital was in doubt. It would not have been surprising if the outbreak of war had put a very different aspect on their affairs, but few companies had suffered relatively as little as theirs. Their loans and investments had given undiminished returns, and, so far as they could be valued, were worth little less now than the figure at which they stood in the balance sheet. The one doubtful element, singularly enough, happened to be the most legitimate investment which an electrical trust company could undertake, the Constantinople Telephone Co. He was personally acquainted with the city, and did not know of any city of equal size which afforded such splendid scope for telephone enterprise. The concession was only granted a few years ago, and the service had only been started a few months before this country went to war with Turkey. Obviously, the present state of affairs in Constantinople gave the owners of the telephone company great anxiety, but they by no means despaired of the future. There was every reason to believe that the system had suffered little or no physical damage, and in the long run their interests should suffer little. However, their interests in this company represented less than one-seventh part of their total investments, so that in no event would the loss be serious. The remainder of their investments had given little cause for any anxiety. With regard to loans, one loan represented £25,000 out of a total of £35,000. Litigation arose over this, but they established their case in the Courts. All their expenses were paid, and they received a very substantial proportion of the loan, and the balance was being paid by monthly instalments, and, at the same time, they received a very remunerative rate of interest.

Mr. Wright seconded the motion, and the report was adopted without discussion.

Mr. Kingsbury remarked that he had had something to do with the initiation of the Constantinople Telephone Co., and he felt the greatest confidence in his holding. Constantinople was the only city in the world with a million inhabitants without telephone communication. It had now a system installed with all the experience of a quarter of a century's work behind it. At the present moment *force majeure* was interfering with the company's interests, but before long *force majeure* would be the other way round, and then there could be no doubt of the steady improvement of the position of the company.

Telegraph Construction and Maintenance Co., Ltd.—The directors have declared the usual interim dividend of 5 per cent.

Chili Telephone Co., Ltd.

The aggregate number of subscribers at all centres at the end of the year (March, 1915) was 13,095, a decrease of 880 for the year. The gross revenue in Chile from all sources was $3,163,530, an increase of $6,527. The expenditure in Chile was $1,647,933, an increase of $27,112. The net income in Chile from all sources was $1,515,597, a decrease of $20,585. The average rate of exchange for the year was 8.46d., as compared with 9.60d. in the previous year, giving a decrease for the year of 1.14d. Converted into sterling at this rate, the net income figures are £53,424, a decrease of £8,030. The liquid assets and liabilities in Chile at March, 1915, were valued at 7¾d., the current rate of exchange at that time, as compared with 9¼d. a year previously. The balance to the credit of the revenue account, including £3,956 brought forward, is £51,921, of which £3,838 has been expended on replacements, etc., of plant. An interim dividend of 3s. per share, free of income tax, was paid on January 15th last, and after carrying £12,344 to the general reserve and setting aside £5,000 as a special reserve against loss on investments, the directors now recommend a final dividend of 5s. per share, free of income tax, leaving £4,339 to be carried forward.

Annual meeting: July 14th.

General Electric Co., Ltd.

The directors report that for the year ended March 31st, 1915, the net trading profits and income from investments, &c., amount to £164,877, plus £36,740 brought forward, making a total available profit of £201,617. Debenture interest required £8,000; depreciation and provision for removal expenses, £18,855; and the dividend on the preference shares (6 per cent.) absorbed £38,681, leaving an available balance of £136,081. Out of this, managing director's and employés' bonus requires £9,934; balance of expenses of new issue of capital, £13,822; dividend on ordinary shares (10 per cent.), £48,142; reserve account, £20,000; war grants, £7,482, leaving £36,701 to be carried forward. The balance of the reserve account at March 31st, 1914, was £200,000, plus for 1915, as above, £20,000, giving a total of £220,000.

The war has interfered with the company's plans for extension, but, so far, has not affected the volume of business, as the great increase in orders from Government Departments and Government contractors has fully compensated for the decrease in general business. Although the great majority of the company's products are essential for war purposes, the outlook for the coming year is one of some uncertainty, owing to the absence with His Majesty's Forces of nearly 1,000 of the company's most skilled staff and workpeople, and owing to the unsettled state of the labour and raw material markets. Extensions at the Witton Works are now being carried out. The Pirelli-General Cable Works at Southampton have been completed during the year and have started manufacturing. The steelwork of the Kingsway building is erected, but the board have decided to defer completion of the building to a more suitable time. The issue of £400,000 additional capital during the past year has been a great success, and the expenses in connection with such issue are finally disposed of in the accounts.

Mr. J. Y. Fletcher and Mr. S. D. White were appointed directors on January 4th, 1915.

Annual meeting: To-day, July 9th.

We give below the comparable figures from the reports for the three years ended March, 1913, 1914 and 1915:—

	1913.	1914.	1915.
Net trading profit and income from investments... ...	£145,261	£157,894	£164,877
Depreciation and debenture interest	32,543	32 328	26,855
Pref. dividend	19,878 (6 %)	24,000 (6 %)	38,681 (6 %)
Available balance	124,890	133,896	136,081
Managing director's and employés' bonus	9,284	10,156	9,934
Expenses of new issue of shares	10,275	14,000	13,822
Staff benevolence	3,000	3,000	—
War grants	—	—	7,482
Ordinary dividend	40,000 (10 %)	40,000 (10 %)	48,142 (10 %)
To reserve account	30 000	30,000	20,000
Balance carried forward ...	32,331	36 740	36,701
Reserve fund total	170,000	200,000	220,000

Russian Electrical Companies.—The Russian Siemens-Schuckert Co. (capital, 15,000,000 roubles) made a profit of 1,149,199 roubles in its fifteenth (1914) working year, and will pay a 5 per cent. dividend.

The United Cable Factories (capital, 6,000,000 roubles) made a profit of 3,337,361 roubles in its ninth (1914) working year, and will pay a 15 per cent. dividend.

Electrical and Industrial Investment Co., Ltd.—A petition for the confirmation of the reduction of capital as agreed at meetings held in March, is to come before the Chancery Division, on July 19th.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—An interim dividend of 2½ per cent. is recommended on the preference shares, but, owing to the uncertainty of the situation, the question of a distribution on the ordinary shares is postponed. Last year the interim dividend was 2½ per cent.

South American Light and Power Co., Ltd.

DURING the year ended March 31st, 1915, the net profit was £10,001, plus £517 brought forward. A dividend of 5 per cent. will absorb £8,620, there is devoted to writing off the debenture issue expenses £1,500, and £398 is to be carried forward.

	March 31. 1913	March 31. 1914.	March 31. 1915.
Arc lamps, connected	733	813	804
8-c.p. incandescent lamps, connected	52,234	56,142	56,090
Fans, connected	312	311	329
Motors	91	116	126
Customers	1,706	1,924	2,009

To fill the vacancy caused by the death of Mr. F. O. Smithers, Mr. J. A. Goudge has been elected to the board.

Mr. T. P. GASKELL presided on Monday at the annual meeting, held at Dashwood House, E.C. He said that, unfortunately, they had not done so well as in the preceding year, the receipts having fallen by some £1,700 or £1,800. Despite that, however, after paying a dividend of 5 per cent., they had been able to set aside £1,500 to write off a portion of the debenture issue expenses. With the exception of £500, they had now written off the whole of the £5,911 discount on the issue of the debentures. Although they had had a comparatively bad year, he thought they might say they had now turned the corner. The first nine months of the last financial year—to December 31st, 1914—showed a falling off in gross receipts of £3,370 as compared with the corresponding period in 1913, whereas for the remaining three months there was an increase of £273. That, he thought, indicated that the worst was over, and they now had before them a better prospect than at this time last year. Of course, a great deal depended upon the harvest, which would come forward at the end of the year. So far, their advices went to show that the seeding time had been a good one, and they might hope that the results would be correspondingly good later on.

Mr. EDMUND CHARRINGTON seconded the motion, which was carried.

Puebla Tramway, Light and Power Co.—The directors have issued a circular to the holders of the first mortgage 5 per cent. bonds containing proposals for modifying their rights and the provisions of the trust deed. They state that owing to the falling off in the company's receipts through the disturbed conditions prevailing in Mexico, and owing to the very uncertain value of the peso, it is impossible for the company for some considerable time to assume that its earnings will realise in sterling an amount sufficient to pay the interest on the first mortgage bonds, to say nothing of providing for the sinking fund.—*Times.*

Davey, Paxman & Co., Ltd.—For the 15 months ended March 31st the trading profit was £17,745, making, with the £4,295 brought forward, a total of £22,040. This amount will be applied as follows:—£3,453 to depreciation reserve, £2,375 for directors' fees, £745 to write off balance of South African expenses *re* gas engine installation, £4,530 for one and a-quarter year's interest on debenture stock, and £650 written off patent licences, leaving £10,287 to be carried forward.—*Financial Times.*

STOCKS AND SHARES.

TUESDAY EVENING.

The markets as a whole are partially throwing off the influence exerted over them by the new 4½ per cent. War Loan. Business is still greatly checked, but the severe falls which have been occurring are to some extent arrested. Last week, for instance, there was a rush to sell bank shares, and prices slumped very heavily. This week, people have come in to support them; and a strong recovery in Home Railway stocks is another indication of the way in which the immediate effect of the War Loan is wearing off. Prices of many securities are undoubtedly cheap, and it is not surprising that investors should find it difficult to decide whether duty calls them to subscribe for the War Loan, or to buy more shares of other investments to average holdings acquired at substantially higher prices. Not the least difficult part of a stockbroker's vocation just at the present time is to decide such knotty points for clients who insist upon leaving them to his discretion, because the unfortunate man knows that whatever he does will be wrong.

There seems to be little doubt as to the success of the Loan: and the offer of a thousand million dollars to the United States is evidence that those in charge of the issue have awakened to the desirability of attracting American money to this country—not only for the purpose of getting the money itself, but for assisting the rate of exchange, which is still sufficiently against this country to add greatly to the cost of the extensive war purchases now being made by the Allies.

Further falls have taken place in most of our lists, and the reason is still the disposition to sell on the part of those who want to put the money into the new War Stock. Knowing, as they do, the general trend, the jobbers read their brokers as being sellers in advance. The fall of £3 10s. in Telegraph Constructions is, for example, out of all proportion to the number of shares offered for sale. The Company has declared its regular interim dividend of 5 per cent.—that is, 12s. per share; and the yield at the present price is the substantial one of 7¼ per cent.

In their desire to turn sovereigns into soldiers, the public have been over-anxious to get out of existing investments, regardless of the serious indirect consequences which may arise out of this process. Next week, however, should see quotations responding to the better tone which is already perceptible here and there through the House. The War Loan subscription lists close on Saturday, allotment letters will be out in full before the end of another week, and, although for some time to come the War Loan market is bound to be the most brisk in the Stock Exchange, there should be a noticeable return of interest to other securities.

The rally in Steam stocks has brought about a sympathetic recovery of 3 points in Underground Income bonds, raising them to 72. The £10 ordinary shares hardened to 1¼, and Districts are a little better at 13¾. On the other hand, Metropolitan Consolidated went back a trifle.

The Foreign list keeps dull, and there are more falls in the debenture stocks of the Anglo-Argentine Tramways Co., the Five per cents. shedding 4 points, so that they now stand upon the same platform as the company's 4 per cent. debenture stock. Brazil Tractions are the turn harder at 50¼, the Rio exchange keeping fairly steady. Nothing new has occurred in the Mexican division. The death of ex-President Diaz recalls the halcyon days which characterised the decade of his office. However bad may have been the methods by which he brought the country into a condition of order and prosperity, the result seemed to be eminently satisfactory. But since his retirement, four years ago—into which, by the way, he was practically driven—Mexico has been plunged into anarchy and chaos.

The Puebla Tramway, Light & Power Co., in publishing a scheme for funding the interest on its first mortgage bonds, refers to the loss occasioned to the company's revenue by the Mexican upheaval. The exchange, says the report, is now down between 4d. and 6d. per peso, and a further fall is possible. The scheme is for funding the interest on the bonds for five years, during which period it shall be payable only out of net earnings, after the service for the prior lien bonds has been met; any dividends not paid in cash to be satisfied by 5 per cent. non-cumulative income warrants.

The falls in Home Electricity shares include ¼ in City of London ordinary, ⅛ in Charing Cross and Westminster preferences, and 3 points in London Electric debenture stock. Apart from these, the list is fairly steady. Business is quiet in most of the leading issues.

Fresh scaling down has taken place amongst Telegraphs and Telephones. The chief fall is one of £1 in Western Telegraph shares, which at 12¼ are now relatively lower than Eastern Telegraph ordinary. Anglo-American Telegraph stocks have gone back, Globe Ordinary lost 10s., and New York Telephone bonds fell 1½ to 95. The American Telephone and Telegraph Co. estimates that about 100,000 miles of railroad in the United States are operated by telephone, being two-fifths of the total mileage in the country. According to the company, the proportion would be greater still were it not for the expense of installation. Marconis weakened to 1 11/16, a fall of ¼, notwithstanding the daily expectation of the issue of the company's report. Americans at 12s. and Canadians at 4s. 3d. are less active than they were a week or so ago.

The report of the General Electric Co. shows that the trading profit in respect of the year just passed exceeded that of the previous twelvemonth by about £3,000. It may be recalled that the company issued £400,000 fresh capital last year—half in ordinary and half in preference shares—and the result of this has been to require a further £23,000 to maintain the dividends on the two classes. The *Financial Times* tabulates in convenient form the figures for the past eight years, as follows:—

Year ended 31st March.	Trading profit.	Net profits.	Ord. div.	To reserve.	Carry forward.
	£	£	p.c.	£	£
1908	53,700	34,700	5	2,000	nil.
1909	72,100	51,200	5	16,100	nil.
1910	91,100	68,400	5	22,000	8,900
1911	107,900	86,800	5	43,000*	12,200
1912	112,300	101,200	7½	30,000	32,300
1913	124,000	112,700	10	30,000	32,300
1914	133,100	125,600	10	30,000	36,700
1915	135,100	138,000	10	20,000	36,700

* At the same time £92,100 was written off patents and goodwill out of reserve.

Industrials bear the same marks as the rest. To the drop in Telegraph Constructions reference has been made already. The preference shares of the British Insulated, British Westinghouse, and Callenders have eased off 1/16 to ¼. Babcocks dropped to 2¼, at which price shares have been taken for the North. The Armament division is a little better than it was. Rubber shares keep very steady, upheld by the advance in the price of the raw material to 2s. 7d. per lb., with the prospect of further improvement. Business in this section, however, has not escaped from the check laid upon most markets by the presence of the new War Loan; although when the subscription lists are closed, at the end of the week, rubber shares should be amongst the first to recover from the weight pressing upon speculative investments, as well as upon those of the gilt-edged variety, over the course of the past three weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price July 6, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. do. 4½ Pref.	4½	4	– ⅛	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	—	4 17 7
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13¼	— ¼	6 15 10
do. do. 6 per cent. Pref.	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	—	4 15 8
do. do. 4½ Deb.	4½	90 xd	—	5 0 0
County of London	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 1st Deb.	4½	96 xd	—	4 13 6
do. do. 2nd Deb.	4½	90	—	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4⅝	—	6 3 1
do. do. 4 Deb.	4	82	– 3	4 16 5
Metropolitan	3½	3	—	5 16 8
do. 4½ per cent. Pref.	4½	3⅞ xd	—	6 0 0
do. 4½ Deb.	4½	90 x d	—	5 0 0
do. 3½ Deb.	3½	70 x d	—	5 0 0
St. James' and Pall Mall	10	7¼	—	6 18 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅝	— ⅛	4 17 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	102	—1½	5 17 8
do. Def.	1½	21⅜	— ¼	6 18 0
Chile Telephone	8	6⅜	—	5 18 5
Cuba Sub. Ord.	5	8¼	— ¼	6 1 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅜	— ¼	*6 16 2
do. 4 Deb.	4	82½	—	4 17 0
Eastern Tel. Ord.	7	127	– 3	*6 7 0
do. 3½ Pref.	3½	73	—	4 17 3
do. 4 Deb.	4	81	—	4 18 9
Globe Tel. and T. Ord.	6	10½	— ½	*6 13 8
do. Pref.	6	11¼ xd	—	5 6 8
Gt. Northern Tel.	22	34	—	6 9 5
Indo-European	65/-	52	—	6 5 0
Marconi	20	1¾	— ⅛	11 17 0
New York Tel. 4½	4½	95	—1½	4 13 0
Oriental Telephone Ord.	10	1⅝	— ⅛	5 6 8
do. Pref.	6	1⅛	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	5⅜	— ⅛	*7 19 10
do. Pref.	5	4⅝	— ⅛	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12½	—1	*6 10 6
do. 4 Deb.	4	83	—	4 16 5
HOME RAILS.				
Central London, Ord. Assented	4	73	—1	5 9 7
Metropolitan	1½	25½	— ½	4 18 0
do. District	Nil	13½	+ ¼	Nil
Underground Electric Ordinary	Nil	1½	+ ⅛	Nil
do. do. "A"	Nil	4/6	—	Nil
do. do. Income	6	72	+3	*9 10 6
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	4⅛ xd	— ⅛	6 13 4
do. 2nd Pref.	5½	8⅜ xd	—	7 11 9
do. 4 Deb.	4	79 xd	—1	5 1 0
do. 4½ Deb.	4½	80 xd	– 2	5 12 6
do. 5 Deb.	5	79	—1	6 6 7
Brazil Tractions	6	60½	+ ½	11 17 8
Bombay Electric Pref.	6	10½	—	5 16 10
do. 4½ Deb.	4½	90 xd	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	50	—	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	– 2	5 2 0
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2½	— ¼	6 4 5
British Aluminium Ord.	5	1⅛	—9d.	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	— ¼	5 0 0
British Westinghouse Pref.	7½	33/-	– 1/6	8 2 2
do. 4 Deb.	4	70 xd	—	5 14 4
do. 6 p. lien	6	100	—1	6 0 0
Callenders	15	11½	— ¼	6 13 4
do. 5 Pref.	5	4¼	— ⅛	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1⅔	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9¾ xd	—	6 3 1
Henley	20	14	—	*8 3 3
do. 4½ Pref.	4½	4⅔	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8⅔	—	5 14 3
Telegraph Con.	20	33	—3½	7 5 6

* Allowance made for dividends being paid free of income-tax.

St. James' and Pall Mall Electric Light Co., Ltd.—An interim dividend at the rate of 7 per cent. per annum on both the preference and ordinary shares for the half-year ending June 30th, 1915, has been declared, payable August 7th. The transfer books will be closed from July 24th to August 6th inclusive. The interim dividend paid on the ordinary shares last year was at the rate of 10 per cent. per annum.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	..	..
a „ Sulphuric	per cwt.	..	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£40	..
a Bleaching powder	„	£9	..
a Bisulphide of Carbon	„	£21	..
a Borax	„	£22	..
a Copper Sulphate	„	£29	..
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
a Methylated Spirit	per gal.	5 0	..
a Potassium, Bichromate, in casks	per lb.	7d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/6	..
a „ Perchlorate	„	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	..	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	1/1	2¾d. inc.
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8¼d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£115	£10 inc.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£145	£10 inc.
b „ Sheet, in ton lots	„	£145	£10 inc.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/2½ to 1/2½	..
c „ Tubes (solid drawn)	„	1/2¾ to 1/3	..
c „ Wire, basis	„	1/2½ to 1/2¾	..
c Copper Tubes (solid drawn)	„	1/2½ to 1/2⅝	..
g „ Bars (best selected)	per ton	£110	..
g „ Sheet	„	£110	..
g „ Rod	„	£110	..
d „ (Electrolytic) Bars	„	£95	£1 dec.
d „ „ Sheets	„	£113	£1 dec.
d „ „ Rods	„	£101	£1 dec.
d „ „ H.C. Wire	per lb.	1/0½	¼d. dec.
f Ebonite Rod	„	8/-	..
f „ Sheet	„	2/6	..
a German Silver Wire	„	1/10	1d. inc.
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/7½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	67/6	1/- inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£22	..
g Lead, English Pig	„	£25 10	10/- inc.
g Mercury	per bot.	£17 5 to £17 10	£1 10 inc.
c Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/3½	..
p „ „ rolled strip & sheet	„	1/3½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£80	..
g Tin, Block (English)	„	£172 to £173	£2 to £3 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

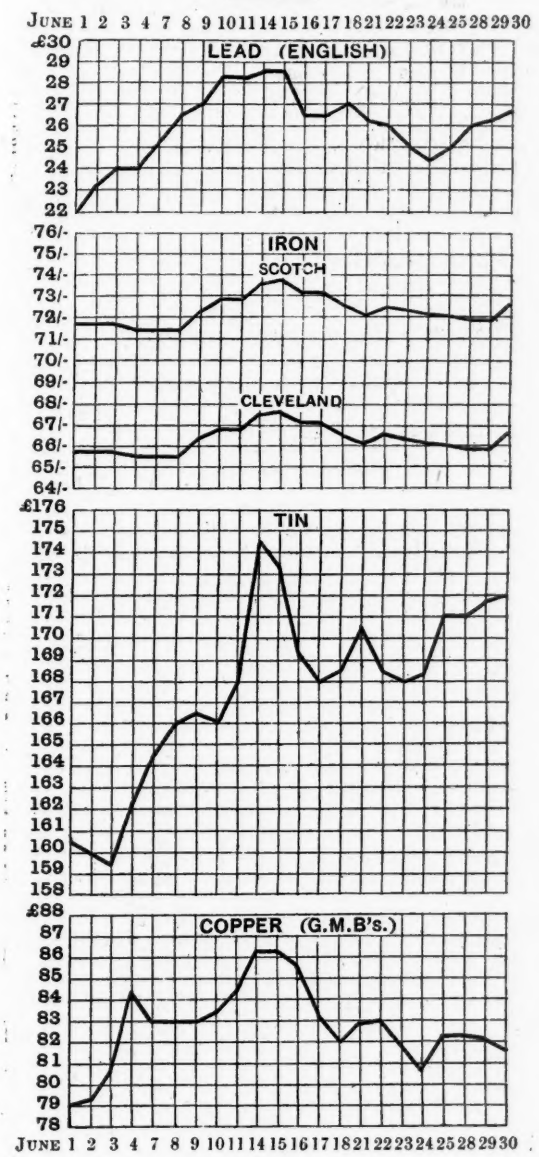
a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Waygood-Otis, Ltd.—Mr. H. C. Walker presided at the annual meeting, held at Cannon Street Hotel on June 28th. He said that a year ago when they met they were suffering from the effects of the building strike, but were anticipating a revival consequent upon its settlement. Circumstances were, however, entirely altered by the outbreak of war. It was anticipated in the early months that business would be seriously affected, but later months brought greater confidence. Higher wages had been granted in consequence of the cost of living, and 300 of their men were with the Forces. They were now engaged upon important contracts, and they were looking forward to the future with confidence. The advantages anticipated as the result of the amalgamation with the Otis Co. were gradually being secured. This time they were not able to pay the ordinary dividend, as they had hitherto been able consistently to do.

Bell Telephone Co., of Canada.—A quarterly dividend of 2 per cent. on the capital stock is payable July 15th.

METAL MARKET.

Fluctuations in June.



The Electric Driving of Saw Mills.—Although in the older method of driving saw mills with steam engines it has been the practice to burn the refuse in the boilers to raise steam, this is not a valid objection to electric driving from the public mains, for it is found that the refuse can be sold, and commands a ready market. An electrical installation was recently laid down by the General Electric Co., Ltd., at Mr. Geo. Shipway's electric saw-mills, Camp Hill, Birmingham, taking three-phase power at 25 cycles, 440 volts, from the mains of the Birmingham Corporation. The current is distributed from an ironclad switchboard to a number of "Witton" induction motors of the open type, varying in size from 50 H.P. downwards. These have been running for a considerable time, and have given the fullest satisfaction. The electric saw mills are situated in one of the busiest parts of Birmingham, where space is valuable, and the motors are mounted on the ceiling, or installed in concrete pits directly below the machines they are driving. In each case the controlling switchgear is situated close to the driven machine. The whole of the floor space is available for the ordinary operations, and in no case is any room taken up by belting or shafting.

Invited to express his opinion on the performance of the electric drive, Mr. Shipway emphasised its economy. To his mind, one of its most valuable features was the ability to shut down those of the machines which were not required, and to run one or more machines as desired through the breakfast hour, or on overtime, should pressure of work make such a procedure desirable.

A NEW BRITISH INDUSTRY.

THE manufacture of batteries for portable electric lamps, &c., has assumed special interest at the present time, mainly owing to the fact that the German competition is removed for the time being, so that a good opportunity offers to establish and maintain a British supremacy in this line.

We intend here only to consider batteries of the "dry" type and not accumulators, which latter, owing to their necessarily higher price, are, if better, not so readily saleable, and cannot therefore be made in such large quantities.

"Dry" batteries, on the other hand, more particularly refills for pocket lamps, torches and the like, have been turned out by Germany by the million, and as the cheapest labour can be employed in their manufacture, a good profit can be obtained, even with the low prices which ruled before the war. In fact, the Germans have persistently flooded the world to such an extent with these batteries that a huge demand has been created, which so far cannot possibly be met by this country, either as regards quantity, or, and this is really most important in view of the after-war business, quality.

Batteries or refills of the type under consideration consist usually of two or three cells which are connected in series, and which are contained in a common case mostly made of thin cardboard.

Each cell is composed of a cylindrical or square section vessel made of zinc, which acts as negative electrode and at the same time as container for the electrolyte and the positive electrode.

The zinc vessel is made of No. 5 or so gauge sheet, the thickness being selected according to the length of useful life required of the battery, and is open on top but otherwise carefully soldered, so as to render it quite watertight. This is an important point, as in the case of even a slight leakage, the water contained in the electrolyte would speedily disappear and render the cell inactive.

The carbon electrode is made up by moulding round a circular section carbon a mixture of graphite, manganese dioxide and water, so as to form a cylindrical body, from which the central carbon projects, say, $\frac{3}{4}$ in. The moulded cylinder is kept in shape by means of a wrapper of loosely woven fabric tied with thread.

To the projecting end of the carbon a tightly fitting brass cap is fixed, which is used for making the electrical connection.

The electrolyte is in the form of a more or less viscous paste, usually made with a starchy basis, and containing one or more of the salts of ammonium. Many recipes are extant, but a good formula is :—

8 parts H_2O (distilled)
2 parts NH_4Cl
1 part NH_4SO_4

A sufficiently stiff paste should be made first by stirring into the water an adequate quantity of pure starch of some sort (wheat, rye or rice flour, &c.), and bringing it to the boil. After the paste has cooled somewhat the ammonium salts, which have preferably been finely powdered and thoroughly mixed, are worked in.

The purity of the materials used is very essential, and the ingredients mentioned must never come into contact with metal before being filled into the zinc vessels.

The same remark applies to the carbon, graphite and manganese dioxide used in the positive electrodes. In fact, the purer the materials are, the higher the E.M.F. obtained and the longer the life of the batteries will be.

The paste from which the carbon cylinders or positive electrodes are made should contain a preponderance of manganese dioxide, the actual ratio depending very largely on the obtainable material. For a rough approximation the following formula—

One part graphite
Two parts manganese dioxide

is near enough.

Supposing zinc vessels, carbon electrodes and electrolyte to be ready, the zinc vessels would be filled to a point such that, with the carbon electrodes inserted, the electrolyte

just covers the graphite-manganese cylinders. Care should be taken that the brass contact caps are quite clear of the electrolyte.

In order to prevent the corrosion of the contact caps through liquid electrolyte creeping up in the central carbon through capillarity, it is advisable to dip the top part of the carbons in hot paraffin or wax, so as to fill up the pores. The electrical conductivity of the carbons is not affected by this operation in the least.

It is also well to soak the graphite-manganese cylinders in a strong solution of ammonium salts before insertion, as this prevents a portion of the liquid in the electrolyte from filling up the pores of the cylinders, which would result in an increase of internal resistance and a corresponding drop in voltage.

It is a mistake to press the graphite-manganese cylinders from paste containing too little water, as they would not be porous enough, and would only act on their surface instead of right through.

Perhaps it would be well to say a few words about the chemistry of these "dry" cells. As a matter of fact, they are not dry. If they were they would not act. The electrolyte may appear to be dry or nearly so, especially in cases where sulphate of calcium is used instead of starch, but it is just in order to prevent any evaporation that the little cells described above are generally hermetically sealed by means of pitch, paraffin, or the like.

Of course by using, say, nitrate of ammonium, which is highly deliquescent, in the electrolyte, the evaporation can be counteracted more or less successfully and hermetical sealing obviated.

The result to be aimed at is always to get the materials which act on each other as evenly balanced as possible, that is to say, while no surplus gases should be developed, in order to do away with the necessity of vents, a sufficient store of salt should be contained in the electrolyte. Otherwise the chemical action cannot be sustained long enough to give a reasonable useful life.

The cell used in the batteries under review is really our old friend the Leclanché, with greatly enlarged electrode surfaces in close proximity to each other, in order to reduce internal resistance to a minimum.

The composition of the cell can be represented by the following formulæ :—

$$Zn \mid NH_4Cl + H_2O \mid C + MnO_2.$$

When in action, zinc is being dissolved, freeing hydrogen, which in its turn combines with some of the oxygen of the manganese dioxide to form water.

If the hydrogen were not got rid of in this way, tiny gas bubbles would fill the pores and cover the surface of the positive electrode, and the internal resistance would quickly increase to such an extent that the battery would become useless. A back E.M.F. would also be set up.

The theory of these cells is complicated, and has not been very thoroughly investigated. Makers have generally proceeded in an empirical way, and guard their secrets jealously. It would appear that most modern dry cells, at least those which are used for pocket lamps, &c., are really what is called "concentration" cells, that is to say, cells containing two solutions of different concentration, separated by a suitable porous membrane.

In such a cell an E.M.F. additional to the potential differences due to the contact of electrodes and electrolyte is set up, and this is the reason that batteries built on very similar lines by different makers show appreciably different voltages.

Of course the difference in concentration disappears in the course of time as the solutions mix, but in cells as dealt with here, the voltage should not sink below about 1·5 volts until they are nearly exhausted.

The theoretical consumption of zinc is $2/E$ lb. per H.P.-hour where E is the E.M.F. of the battery. Differently put, in a 4·5-volt battery working a ·4-amp. metal-filament lamp, the consumption of chemically pure zinc would, theoretically, be about 7·5 grains per hour.

Some local action takes place even when the battery is open-circuited, *i.e.*, not working electrically, and the concentration of the electrolyte and the strength of the zinc vessels must be selected appropriately to obtain the best results.

As indicated above, hard and fast rules cannot be laid down, as not only the ammonium compounds, but also the graphite, the manganese, &c., and last, but not least, the zinc, vary considerably according to the source of supply. Some experimenting will always be necessary in order to ascertain the best proportions for the materials at one's disposal, but if this be carried out on the lines indicated there should not be many difficulties.

In a further article it is proposed to deal with the tools used in making the various component parts of the complete refill, and to give notes about preparing and filling in the electrolyte, and sealing the finished battery.

As most of the work can be carried out by young girls, and in view of the fact that the coming season is sure to bring a large demand for these refills, manufacturers who are not too busy on Government work would do well to give their attention to this comparatively new industry.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

Annual Report.

THE annual report of the Council states that since it has become evident that there is little likelihood of Major Richardson being able to give his services to the Association throughout the ensuing year if he were re-elected to office, his views have been ascertained, and in conformity with the same the Council suggests that his name should be placed on the list of Past Presidents, and that at the first opportunity he should be nominated for another term of office as President. The membership of the Association now stands at 377, a decrease of two on last year's total.

Regarding the model general conditions of contract placed before the annual general meeting in June, 1913, it was resolved that the Association of Municipal Corporations should be consulted, but that body did not move very quickly. In the meantime the Council of the B.E.A.M.A. decided to adopt the model general conditions as issued by the Institution of Electrical Engineers for a period of one year in respect of municipal contracts in order to see how they worked. The B.E.A.M.A. asked for the views of the Council upon this proposal, but under the circumstances no reply could be given, and the matter is left, as heretofore, for each corporation to deal with the manufacturers direct.

With respect to the I.M.E.A. Bill, the Council decided that no further action be taken in connection with the suggestion for a joint private Bill, and that the Association revert to the pressing forward of a Bill promoted in the manner originally arranged.

The Acting President, Mr. A. C. Cramb, had an interview with Mr. Rawlings, the President of the Electrical Contractors' Association, as a result of which the Council decided that no further concessions be made beyond those contained in the Bill as last printed.

After careful consideration of the results of the I.M.E.A.'s Parliamentary propaganda in support of the Bill, Messrs. A. C. Cramb, Bailie Smith, A. H. Seabrook, S. E. Fedden and H. Faraday Proctor were appointed as a sub-committee to meet the B.E.A.M.A. with a view to discussing this question with them.

Particular attention is drawn to the fact that the Corporation of Glasgow has arranged terms upon which it will operate its publicity and sales departments. The Electrical Contractors' Association in Scotland have agreed to terms less advantageous to themselves than those to which the Electrical Contractors' Association take exception in the Bill.

Negotiations are in progress in connection with the question of obtaining powers for local authorities to pay delegates' expenses to annual conferences.

A year ago the Association was invited by the Engineering Standards Committee to nominate two members to represent it on the newly-constituted Sectional Electrical Committee. Mr. A. H. Seabrook and Mr. A. C. Cramb (Acting President) were nominated, and subsequently additional representation was obtained on many of the sub-committees dealing with electrical plant.

The Council has since voted a sum of twenty guineas from the funds of the Association as a donation from the I.M.E.A. to the Engineering Standards Committee.

The Council makes a special appeal to the committees who control municipal electrical supply undertakings to give their generous support to the Standards Committee by making an annual subscription towards the fund.

With regard to the Development Committee formed at the first Council meeting of the session, Mr. Vignoles was appointed hon. secretary, but had volunteered and been accepted for war service. At the request of the Council, Mr.

J. W. Beauchamp accepted the hon. secretaryship of the committee for the time being. Representatives of kindred associations and other persons likely to be of service were co-opted as members, and the work so far accomplished is set out in the Development Committee's report.

Referring to the Long Eaton and Ilford cases, the Council asked the hon. secretary to draw up a statement as to the danger of the gas company's attack and circulate it to the local authorities represented in the Association, asking them to contribute to the expenses of supporting a test case; considerable financial support was promised in response.

Mr. Faraday Proctor subsequently presented a valuable report on the subject to the Council. Having carefully examined the tariffs of over one hundred of the municipal undertakings, he was of opinion that there were only a few which might be subjected to attack on the grounds of the objections alleged in the Long Eaton and Ilford cases. Some of these cases were at the time receiving consideration with a view to amendment, and in other cases the engineers were prepared to recommend amendments if such were thought desirable. The ground would therefore appear to be clear at least as regards the tariffs put forward by the large number of members who replied to the letters of inquiry.

With reference to the moral support given by the Council to the petitions against the Yorkshire Electric Power Co.'s Bill by certain municipalities, as set forth in the last report, a communication was subsequently received from the Association of Electric Power Companies in which it was suggested that the I.M.E.A. had not realised that the Yorkshire Electric Power Co. were only seeking to get lighting powers in the areas in which under their existing Acts they could already supply power. This materially altered the position, and steps were at once taken to make it clear that if the I.M.E.A. had been informed at the time as to the limits of the powers sought by the Yorkshire Electric Power Co., active opposition would probably not have been given.

The Tungsten Lamp Association invited the Council to send representatives to form a joint committee to discuss the outlines of the specification proposed to be put forward by the Tungsten Lamp Association. As the Council was already represented on the Sectional Committee of the Engineering Standards Committee dealing with a similar subject, they did not see that any useful purpose would be served by meeting the Tungsten Lamp Association, bearing in mind the views which the I.M.E.A. representatives held on the matter.

The Council records with satisfaction and pleasure the honours conferred upon Mr. J. F. C. Snell, a past president of this Association, his Majesty the King having bestowed knighthood upon him in recognition of his services to the electrical industry, and the Institution of Electrical Engineers having elected him as their president.

The Council has had under consideration the action of the Local Government Board in refusing loans for extensions, etc., owing to the war, but felt that it could not recommend action being taken on general lines. The case of each undertaking should be considered upon its merits.

With the object of ensuring that members of the staff of electricity undertakings should not be accepted for enlistment without special permission, the War Office had been approached pointing out the desirability of preventing the depletion of the staff below the minimum necessary for the carrying on of the works of electricity departments. The War Office agreed that those who were of necessity engaged on such works were doing equal service to the country as those who had enlisted. The War Office has given consideration to the question of issuing a badge or certificate of exemption, but could not see its way to fall in with the proposal.

The B.E.A.M.A. invited the Council to appoint four members to form a joint Motor Committee. Messrs. A .C. Cramb, A. H. Seabrook, S. E. Fedden and J. W. Beauchamp were appointed to represent the I.M.E.A. The suggestion of the B.E.A.M.A. was that there should be a standard specification which should be adopted by the I.M.E.A., and that an arrangement should be made as to preferential discount to undertakings in their districts where such undertakings have the power to sell motors. The Joint Committee eventually recommended that the I.M.E.A. and B.E.A.M.A. should adopt a standard specification for direct-current motors, preferably that to be issued by the Engineering Standards Committee, and until this was issued, the B.E.A.M.A. motor specification.

Representatives of the Association attended a joint meeting of representatives of the B.E.A.M.A. and the British Engineers' Association to consider the question of the protection of British interests. Proposals were made for the formation of a Government department to be entitled the Board of Industry, or alternatively the appointment of a fully representative committee. It was decided to invite the I.M.E.A. to appoint a representative on the joint committee, one of the main objects being to secure the principle that public money should be expended only on British manufactures. Mr. A. C. Cramb (Acting President) was appointed to represent the Association.

The following resolution was passed subsequently by the joint meeting and the associations represented were asked to adopt it:—

"Resolved that this Association, fully recognising the necessity for the creation of a new Government department whose sole function it shall be to safeguard and promote the industries and commerce of the British Empire, is prepared to co-operate with those other associations who, on the invitation of the British Engineers' Association, have signified their general approval of its proposals that a scheme for the purpose should be prepared and brought before the Government."

The Council appointed Messrs. A. C. Cramb and Thomas Roles as their representatives on the Joint Committee, now designated the Board of Industry Committee.

The Institution of Electrical Engineers submitted to the Council a copy of a report of the Municipal Loans Committee of the I.E.E., which with slight amendment had been adopted by that body. The I.E.E. Committee was preparing a memorandum for presentation to the Local Government Board on the matter. The Council supported the recommendations made by the Institution in regard to the periods allowed for the repayment of loans:—

	Periods recommended. Years.
(*a*) Cables substantially constructed and laid ...	30
(*b*) Conduits substantially constructed	60
(*c*) Accumulators and batteries in cases where the sanctioning authority is satisfied that adequate provision has been made for the proper maintenance of the batteries	15
(*d*) Reinforced concrete	30

The Council decided to subscribe a sum of £10 10s. to the Institution of Electrical Engineers' Benevolent Fund.

The Hon. Treasurer reports for the year ended March 31st that the income from subscriptions remains normal and there is a considerable increase in the revenue from the proceedings (sales and advertisements). There is a surplus for the year of £62 against £65 last year. The total surplus of assets over liabilities is £848. So far the war has had no detrimental effect on the Association from a financial point of view.

Report of the Development Committee.

The full membership at the present time is as follows:—

I.M.E.A. Members.—S. E. Fedden (Chairman), S. T. Allen, F. Ayton, A. S. Blackman, C. McArthur Butler (Secretary, I.M.E.A.), R. A. Chattock, A. C. Cramb, Councillor Crowther, J. E. Edgcombe, Alderman Ellaway, F. M. Long, H. Faraday Proctor, H. Richardson, T. Roles, Alderman Pearson, A. H. Seabrook, Alderman Smith, W. A. Vignoles, G. Wilkinson, J. W. Beauchamp (Acting Hon. Secretary).

Co-opted Members.—Associated Municipal Electrical Engineers (Greater London), W. C. P. Tapper; British Electrical Federation, W. L. Madgen; Cable Makers' Association, L. B. Atkinson; Association of Electrical Power Companies, W. A. Chamen, A. de Turckheim; Electrical Contractors' Association, L. G. Tate; British Electrical and Allied Manufacturers' Association, D. N. Dunlop, A. J. Ireland, G. Maurice, H. C. Siddeley; Society for Electrical Development (America), F. W. Willcox.

Meetings of the Development Committee were held monthly up to the 16th of April, 1915, when it was decided that, owing to the difficulties in carrying out this class of work, brought about by the war, and the increased demand upon the time of members, the meetings should only take place approximately once in three months. Reports of each meeting of the committee are submitted to the Council of the I.M.E.A. for confirmation before action is taken.

In the first instance the following sub-committees were constituted and put in motion—

PUBLICITY SUB-COMMITTEE. (LONDON DISTRICT.)

I.M.E.A. Members: A. H. Seabrook, A. C. Cramb (Hon. Secretary).

Co-opted Members: D. N. Dunlop, C. Palmer, W. C. P. Tapper, L. G. Tate, F. W. Willcox.

ELECTRICAL INSTALLATIONS SUB-COMMITTEE. (BRADFORD DISTRICT.)

I.M.E.A. Member: T. Roles (Hon. Secretary).

DOMESTIC APPLIANCES SUB-COMMITTEE. (BIRMINGHAM DISTRICT.)

I.M.E.A. Members: R. A. Chattock, G. Wilkinson, S. T. Allen (Hon. Secretary).

Co-opted Members: N. Hyde, C. M. Shaw, T. P. Wilmshurst.

Up to date the principal work which the sub-committees have been engaged in has been as follows:—

Publicity Sub-Committee.—The preparation, in preliminary stages, of a scheme of co-operative advertising, printing, and publicity work. The Sub-Committee has interviewed advertising agents and printing firms, and obtained information with regard to the possibilities of producing publicity matter, and for bringing about an arrangement with a suitable firm for the production of such matter under the guidance of the Publicity Committee, and for the payment towards the funds of the Development Committee of some proportion of the profits which might accrue in the sale of such matter to electricity undertakings.

Mr. DUNLOP, on behalf of the B.E.A.M.A., offered office accommodation, and the assistance of himself and his staff, to further these objects particularly in regard to detailed work of purchasing, distributing and collecting accounts in regard to the publicity matter. This offer has been accepted by the Development Committee.

The Publicity Sub-Committee has insisted upon the absolute necessity of providing regular funds and the establishment of at least a small paid staff whose whole time could be

devoted to this class of work, leaving the members only the general direction of the publicity campaign.

The Sub-Committee directs attention to the urgent need of the provisions relating to publicity work which are contained in the I.M.E.A. Bill, and feels that its operations must be heavily handicapped until fuller powers are granted to Municipal Electric Supply Undertakings.

Communication has been opened up with the Publicity Committee of the London Electric Supply Companies with a view to combining the efforts of all classes of electric supply undertakings in regard to publicity, to avoid wasteful overlapping and bring about at the earliest moment an organised campaign for the development of public electricity service. Communications have also been received and considered from the Society for Electrical Development, New York.

Electrical Installations Sub-Committee.—In this case, operations have been very much interfered with by the present abnormal conditions, but the Secretary has reported upon the preliminary stages taken to bring together suitable men for procedure with this work as soon as possible.

For the present the Electrical Installations Sub-Committee will proceed so far as possible:—

To examine, tabulate, and describe the various methods of wiring in use, with advantages and disadvantages, with a view to bringing about any possible reductions in the cost of installation work compatible with safety.

To obtain the assistance and opinions of practical men in touch with this class of work, and to promote discussion on the subject.

To promote practical criticisms of accessories in common use, in connection with installation work, with a view to collating information which would be valuable to manufacturers and users.

To take an early opportunity of considering alternatives to the present design of plug contact for heating, cooking, and other purposes, particularly in regard to the possibilities of superseding the ordinary pin or concentric patterns by some more satisfactory form of plug contact.

Domestic Appliances Sub-Committee.—Here also, considerable difficulty has been experienced owing to the war. The Secretary has reported preliminary work done and plans for the immediate future; the proposition being to carry out various investigations with regard to hot and boiling plates, and to invite the advice and criticisms of manufacturers in connection with that subject.

The Sub-Committee's work will be devoted more particularly to points arising in connection with electrical apparatus primarily intended for domestic use, although also useable for business and other purposes. The scope of the committee's work will cover the whole of the apparatus from its connection with the permanent wiring of the installation, that is to say, from where the work of the Electrical Installations Sub-Committee would leave off.

It is suggested that the Sub-Committee shall also collect and analyse information with regard to domestic electrical appliances, their advantages, cost, etc., and that from engineers and users opinions should be sought, and all such information tabulated with a view to making it readily available to the whole of the Committee. Later, it is hoped to expand into the questions of Hire and Hire Purchase; Costs of maintenance of apparatus; and analysis of existing schemes.

The Development Committee considered a letter published in the technical Press, from Mr. C. H. Wordingham to the Secretary of the I.E.E., dealing with the question of establishing a Central Testing Institution or Proving House, and associated itself with the views expressed by Mr. Wordingham therein, but urged that the National Physical Laboratory and its existing organisation should be employed whenever possible, as further support would enable it to extend its field of operations and would have the advantage of assisting to develop a laboratory which is entirely independent of trade interests.

The standardisation of apparatus has received the attention of the Committee. It is proposed in this connection to work as far as possible in conjunction with the Engineering Standards Committee.

From time to time, the Development Committee has had under consideration the general questions arising out of the I.M.E.A. Bill, the restriction of borrowing facilities, and the difficulties arising in connection with the operation of electricity works under the present conditions, and in view of the shortage of labour. In most cases reports have been made to the I.M.E.A. Council, which body has given the matter further consideration as required.

Report of the Electric Vehicle Committee.

The work of the Committee during the year ended March 31st has covered the following:—

The method to employ in gripping the charging cable to the plug was decided upon and a complete design and specification for the plug and receptacle was published in the March issue of *The Electric Vehicle*. An application was submitted to the Engineering Standards Committee for the standardisation of this accessory, and the Sub-Committee of that body, which dealt with the matter, agreed to recommend the Committee to standardise the dimensions of the contacts, as well as to supervise the manufacture of gauges for them. Two firms in this country are now supplying the fitting in accordance with this Committee's specification.

The Committee attaches great importance to the adoption, as far as possible, of a uniform tariff throughout the country for charging vehicle batteries, and has advocated a flat rate of 1d. per unit for "off peak" supply. The list published contains the names of 105 undertakings that have adopted the Committee's recommendation on this matter.

When the Committee got fully to work, it was soon apparent that funds were necessary in order to make real progress. Up to that time what little expenditure had been necessary, was borne by the parent association. It was, therefore, decided to appeal to all electric supply undertakings for financial support, and the accounts show that the response has, on the whole, been satisfactory. The Accumulator Makers' Section of the British Electrical and Allied Manufacturers' Association contributed £50. The total received amounts to £186.

The Committee decided that it would be of advantage to adopt a definite range of charging voltage, and fixed this range between 85 and 120, which corresponds with the voltage which will take care of the charging of forty-four lead-plate cells, or the equivalent of sixty nickel-iron-alkali cells. The Committee has fixed forty-four as the standard number of cells per vehicle for lead-plate batteries.

The Committee has standardised a design for illuminated and enamel plate charging signs, and has appointed official makers for each type. Full particulars have been published.

To serve as a means of bringing before possible users the advantages of the electric vehicle, the Committee decided to publish a quarterly journal, to which it gave the name of *The Electric Vehicle*, and appointed as the hon. editor, Mr. A. H. Seabrook. At the present time, 4,000 copies are published of each issue, and a large portion of this number is mailed free to corporation officials, chairmen of committees, railway managers, engineers, and others who are interested in transportation generally. It was hoped that corporation electric supply undertakings would purchase quantities for distribution among likely users in their territories, but so far only a limited number of undertakings have made use of this potent means of building up a most remunerative business.

As a further means of drawing attention to the merits of the electric vehicle, the Committee designed and published a series of twelve publicity mail cards intended to be sent, at intervals, to possible users by electricity supply undertakings. Four thousand copies of each of the twelve cards were printed, but with regret the Committee announces that, so far, there has been only a very small demand for these cards.

At the instance of the Society of Motor Manufacturers and Traders, the Engineering Standards Committee decided to standardise certain rims for solid rubber tires, and the Committee recommends that these rims, of the sizes given below, should be used for all commercial electric vehicles:—

670 mm.	741 mm.	850 mm.
720 mm.	771 mm.	881 mm.

Joint meetings were held with representatives from the Tungsten Lamp Association, and, with the approval of those representatives, the Committee advises that lamps of the size and voltage recommended by the Engineering Standards Committee in Report No. 69 be adopted as standard for electric vehicles, and that, in view of the small consumption and the comparatively short hours of use to which such lamps are put, they be for the present coupled across a number of cells in the vehicle to give the required voltage, *i.e.*, 12 volts.

With regard to measuring instruments on electric vehicles, the Committee recommends for vehicles provided with lead-plate batteries, the use of a volt and ampere meter for controlling the charge and discharge. Where, however, it is not proposed to remove the battery from the vehicle, and where no constant attendance is provided during charging, it recommends that an ampere-hour meter should be provided in addition to the ammeter for showing the condition of the battery; suitable provision should be made in connection with the ampere-hour meter for automatically opening the circuit when the battery is fully charged. A mileage recorder is considered a necessary accessory, not only for gauging the condition of the battery in conjunction with the electrical instruments, but for keeping a record of the performance of the vehicle, and its efficiency.

In the case of vehicles fitted with nickel-iron-alkali batteries, an ampere-hour meter is the only instrument which need be provided, other than the mileage recorder.

For alarm signals on vehicles a horn, preferably of the electrically operated type, is the most suitable.

It has been arranged that the Commercial Motor Users' Association will allow the Committee a voice in all future arrangements in regard to parades of motor vehicles in so far as such arrangements apply to electric vehicles. The Association has also offered to allocate to the use of this Committee a section in the next edition of its "Night Shelter Handbook for Commercial Vehicles," in which the Committee can set forth information as to charging stations about the country, tariffs, etc., and to include a map upon which these charging stations may be indicated.

Most useful results have followed upon the continued affiliation with the Electric Vehicle Association of America, through the membership of the Honorary Secretary.

The importance of standard charging equipment and methods of charging has been recognised by the Committee, and, for some time, the Technical Sub-Committee has been hard at work upon it. A full report is in hand, which the Committee hopes to publish shortly.

The statement of accounts shows income £344, expenditure £249, and a surplus of £95 for the year.

On pages 902-3 of our issue of June 25th, we dealt briefly with the proceedings at the annual meeting, when the above reports were adopted.

Mr. S. E. FEDDEN (Sheffield), Chairman of the Development Committee, moved the adoption of the report of the latter, pointing out that it had been decided to form sub-committees to deal with different sections of the work, and also to proceed with the organisation of publicity work.

Mr. R. A. CHATTOCK (Birmingham), Chairman of the Electric Vehicle Committee, who moved the adoption of this Committee's report, drew attention to the large amount of work which had been carried out in the last twelve months in standardising apparatus such as the charging plug, battery sizes, etc., and in connection with charging facilities. He hoped the members would support the journal of the Committee, of which the last issue had been taken up more readily than former ones. The electric vehicle display had been much appreciated by the members, and he hoped it would be repeated in the large towns to impress the advantages of this type of vehicle on the different industries. Many towns were contributing to the funds of the Committee, and he suggested that they should make their contributions annual ones, so as to provide proper financial support to the movement.

The report was subsequently adopted, an appreciative reference being made to the arduous work which had been done by the Hon. Secretary, Mr. Frank Ayton (Ipswich).

Amongst other matters touched on, BAILIE SMITH (Glasgow) dealt with the coal supply question, particularly as to the results anticipated from the Parliamentary deputation and the formation of a Committee of Members of Parliament to report to the Government.

In the interval, the Committee's recommendations have been made public (see ELEC. REV., June 25th, page 895).

Mr. FARADAY PROCTOR also referred to the movement initiated by Mr. F. C. Raphael for providing an adequate supply of switchboard attendants to fill vacancies caused by the war, etc., and it was decided to leave the matter to the Council.

THE WORK OF THE NATIONAL PHYSICAL LABORATORY IN 1914-15.

(*Concluded from page* 6.)

THE principal work of the Electrotechnics section continues to be in connection with the testing of alternating-current apparatus for power measurement. Alternating-current apparatus has been sent for test during the year requiring 6,000 amperes, and the pressures required for precision wattmeters now reach 20,000 volts. There is also a marked tendency to seek for the highest attainable accuracy in steam consumption and similar trials, a demand which is resulting in the production of special forms of integrating test meters for use in this service. An accuracy better than 1 part in 1,000 has always been aimed at in the Laboratory for A.C. power measurements, and there is no difficulty in meeting all demands in this respect.

In the measurement of electrical power by an electrostatic instrument a high resistance is placed across the voltage terminals of the instrument under test if the voltage be more than 100, and a tapping corresponding with 100 volts is connected to the needle of the wattmeter. In practice a resistance of 100,000 ohms is used for voltages up to 5,000. Tappings are made at every 2,000 ohms up to 20,000, and at the subsequent 20,000-ohm points. In this manner the fractions $\frac{1}{10}$, $\frac{1}{20}$, $\frac{1}{30}$, &c., of the main voltage down to 1 can be obtained, besides many other ratios if desired. The checking of such a resistance with low voltages is very simple, and may be conveniently done by successive substitution in one branch of a Wheatstone quadrilateral; any convenient resistances may be used for the other three branches, and balance may be obtained by a variable resistance in series or parallel with one of them. There are ten resistances of 2,000 ohms, which should all be equal, and the sum should be equal to each of the larger sections. The resistances are high, rendering that of connecting wires negligible. Absolute correctness of the resistances is unnecessary, as it is only the ratio of the different sections that is of importance.

In the current circuit a resistance is inserted which will cause the voltage drop of about two volts required to operate the wattmeter. For testing commercial instruments a range of resistances, varying from a few ohms down to a thousandth of an ohm, or less, is required, and for three-phase tests three of each size, amounting to about 30 resistances in all. It is essential that the value of these in terms of the international ohm shall be accurately known. It is, therefore, desirable that apparatus should be available for quickly verifying any of these resistances by comparison with a standard one-ohm coil whose value is known to a high accuracy. It is also essential that resistances in daily use for work of this nature should have a simple numerical value, thus saving a large amount of arithmetical calculation. Any difference from the nominal value should, therefore, be small enough to be negligible in all ordinary work. In practice the resistances are adjusted until the errors do not exceed two or three parts in 10,000, an amount which is corrected for when work of the highest precision is in progress.

The comparison of resistances such as a tenth of an ohm or a thousandth of an ohm with a standard 1-ohm resistance is a relatively simple matter when the resistances have even values. A Kelvin bridge consisting of a number of equal resistances, which need not be adjusted to any particular value, is all that is required, and during the year the design and construction of such an apparatus has been completed.

It consists of two rows of 25 resistances, each unit being 20 ohms. In general some of the resistances are short-circuited, the number depending on the ratio of the main resistances under test. The arrangement is capable of comparing two resistances whose values have an integral ratio denominated by m/n where m + n does not exceed 25. For verifying low resistances of the order of 0·001 of an ohm it is necessary to use intermediate resistances such as 0·1 and 0·01 ohm, using a ratio of 10 to 1 for each step. In such measurements any errors due to inequalities among the 20-ohm resistances are cumulative. It is, therefore, necessary to adjust these to equality with a high degree of accuracy, for the error due to this cause must not exceed 2 or 3 parts in 100,000 in order that the accumulated error in a low resistance, verified in three steps, shall not exceed 1 in 10,000. Balance in the galvanometer circuit is obtained by shunting whichever of the main resistances under comparison is relatively the higher.

Two new water-tube resistances of 0·001 ohm to carry normally 2,000 amperes with an overload to 3,000 amperes have been completed and taken into regular use during the year; also a set of three 0·04-ohm tubes for 500 amperes. These complete the standard resistances required at present for large currents, and it will be of little use extending the range and building resistances for 6,000 amperes until the transformer capacity for obtaining large currents has been increased. Some useful resistances have also been made up for currents up to 25 amperes, consisting of resistance wire wound on frames, with air cooling. The wire is silk covered and again silk wound into parallel twin wires, so rendering the inductance as low as possible. Each wire is arranged to carry 0·5 ampere, dropping two volts across the terminals. As many of these lengths as necessary are put in parallel to make up a resistance of the required magnitude. They will replace the resistances which have been used hitherto for smaller currents, and which consisted of a network of some 20 exceedingly fine bare manganin wires in parallel stretched between terminals and immersed in oil. The large cooling surface and low inductance of these left nothing to be desired, but with the very fine wire transmitting heat rapidly to the oil, sufficient constancy could not be obtained, although every effort was made to protect the alloy with varnish. A gradual change has been taking place in the resistance values for several years, and it has, therefore, been decided to discard them for use in routine work, where the application of corrections is to be avoided wherever possible.

The new three-phase switch for operating the electrostatic wattmeter on three-phase circuits up to 20,000 volts has been in use throughout the year, and three-phase meters have been tested for accuracy with both their current and potential transformers. This represents a considerable step forward in assuring the highest possible overall accuracy of meters for large powers, and has also helped to accelerate the operation of testing them.

The switch, which is of a rotary type, is actuated mechanically from a distance by a flexible steel cord, by means of which the switch can be located in the danger area, and the operating handle be at the hand of the observer who reads the electrostatic wattmeter.

At present, for lack of suitable dividing resistances, it has not been possible to use this switch on circuits above 6,600 volts. Nor, in fact, have single-phase tests to the best accuracy been possible above 11,000 volts. For this reason resistances have now been put on order to increase the range of the highest precision tests up to about 40,000 volts, and at the same time to permit three-phase meters to be tested with their potential transformers up to 11,000 volts. The present dividing resistances consist of two 100,000-ohm sub-divided woven gauze boxes, each capable of use on 5,000 volts. A third one is now to be added exactly similar to the others, and, in addition, sufficient gauze resistance is on order to enable three further boxes, each of 120,000 ohms and of the same current-carrying capacity, to be built at the Laboratory.

The electrostatic wattmeter has been used now for several years with a temporary scale having an arbitary constant. Opportunity has been found in the course of the year to draw a new scale, which is direct reading. It is about 6 m. long, with 3,800 divisions each of approximately 1·5 mm., the precision of reading being to one-quarter of a division.

The new electrostatic voltmeters with light moving systems and bifilar suspensions have been constructed and tested. They have, however, exhibited an unexpectedly large contact difference of potential, which, unless remedied, would detract from the convenience of the instrument in practical use. The matter is, therefore, being looked into in order that the defect may be remedied.

A number of tests have been made on the smaller-sized switches to determine their rating. The principle followed in carrying out these tests is to ascertain the current a switch just fails to break at different voltages, and also the current which produces a "flare" on break. Curves can then be drawn connecting voltage and maximum current. Such curves show that a 50 per cent. increase of voltage is much more exacting than a 50 per cent. increase of current. In breaking a circuit with constantly increasing currents a point is reached when the arc is drawn out far enough to bridge the contacts. As a rule, when this point is reached, there is a marked increase in the tendency to flare—the arc assumes more the character of a flame, and lasts for a longer period. It will continue to break the circuit, however, beyond this point, but in double-pole enclosed switches the presence of a flaming arc on

breaking is a source of danger, since short-circuits often occur through the agency of this flame; generally, therefore, the point of flaring marks the maximum possible breaking current for such switches.

Tests have been made on large current transformers up to 6,000 amperes, but difficulties arise due to lack of supply transformers which will give currents of this magnitude. Efforts have been made to determine the order of agreement to be expected in such cases when smaller currents are passed through the transformer a correspondingly larger number of times, thus working with an equivalent number of ampere turns. For precision work this method is not to be recommended, unless exhaustive tests show that it gives correct results for the type of transformer under consideration.

Measurements have been made on the skin effect in two large stranded cables about 1 sq. in. in section.

There has been a large increase in the amount of test work over the previous or any other year. For the portion of the year up to July the work was normal, and slightly lower than in the previous year. As a result of the war, however, there has been a large increase in the Admiralty work and a falling-off in the number of general tests for private firms.

Research work on the heating of buried cables has made good progress during the year. The experimental work was commenced at Bristol, a series of tests, extending over a period of three weeks, being carried out on a number of cables, of size ranging from 0·1 to 0·3 sq. in., laid direct in the ground.

The supply was alternating current, and on one of the larger cables tests were made with frequencies of 50 and 93 cycles per second.

For the measurement of the resistance of the conductor a double bridge method was used, a small continuous current being superimposed on the alternating current by means of an accumulator connected in series with the secondary winding of the transformer. This method proved to be quite satisfactory, allowing of mean observations being taken, with the portable apparatus used, to an accuracy of 0·1 per cent.

Other tests were made at St. Marylebone with some 2-sq. in. machine feeder cables when carrying their normal load of from 2,000 to 2,400 amperes, and at Wolverhampton with two cables, one laid solid in bitumen and the other drawn into a duct.

It has been possible, by slight modification of the Callendar recorder, to make it suitable for the purpose of obtaining records of the temperature of cables under normal conditions of loading. This instrument has, therefore, been purchased, and is now in use. Tests with it have already been made at St. Marylebone with a number of 1-sq. in. and 0·5-sq. in. feeder cables drawn into multiway ducts, and at Wolverhampton with single cables drawn in and laid solid; it is now installed at Glasgow, giving records of 1-sq. in. triple-concentric cables laid solid in bitumen. The records obtained, showing the heating and cooling of the cable when carrying its normal load over a period of a week, are most interesting.

The work of laying the experimental cables at the Laboratory has been held up for the present, owing mainly to the difficulty of obtaining the necessary cable and labour.

Tests on the temperature rise in twin flexible wires have been completed, and show that very high temperatures are in some cases attained on the portion of the flexible wires nearest to the heating apparatus. This, unfortunately, occurs mainly in the case of small portable apparatus, where the mechanical strain on the wire is greater than with apparatus designed for stationary use.

Heat.—The Laboratory has adopted as its fundamental scale of temperature the Centigrade Thermodynamic scale, which is realised with the exactness required for work of the highest precision in the scale of the constant-volume hydrogen thermometer in the interval between 0° C. and 100° C. From 0° C. to the boiling-point of sulphur (444·5° C.) the practical scale is realised with sufficient accuracy by the platinum-resistance thermometer, as well as by known fixed points with which it is extended to 1,083° C. It has been found that the temperature of the boiling-point of sulphur can be realised in practice to a high degree of accuracy under widely differing conditions.

Improvements have been made in the apparatus available for resistance thermometry.

In connection with the heat losses from cement kilns, an investigation has been commenced into the loss of heat from hot surfaces, a subject on which few reliable data are available. The research includes both flat surfaces and a series of tubes of widely varying diameters. The experiments are directed to the simultaneous determination of the total heat-loss and of the pure radiation, and hence indirectly of the convection.

Results for plane surfaces of various kinds and at temperatures up to 600° C. have already been obtained by very diverse methods, and have led to interesting conclusions, some with an important practical bearing.

Although it has been known ever since the early experiments of Leslie and Count Rumford that a polished surface emits only a small fraction of the radiation given out by a black surface, surprisingly little light has been thrown on the problem of the heat dissipated by a surface since the time of the pioneer workers such as Péclet, Dulong and Petit. The effect of various paints and other coatings on the total emissivity was first investigated, particularly with a view to the possibility of diminishing appreciably by some sufficiently cheap process the radiation from a surface whose emissivity was nearly that of a black body.

As all methods of imparting to the metal a smooth and bright reflecting surface were impracticable by reason of cost, a study was made of the different processes for metallising the surface by application of metallic paint or by the new spray process.

As instances of the nature of the results obtained, may be mentioned first, that over the range of temperatures met with in steam engineering the true radiation-loss, this fraction dependent on the nature of the surface, is approximately half the total loss in pipes of ordinary iron under the usual conditions; and, secondly, that the true radiation from an iron surface may be diminished to one-half of its normal amount by suitable application of a coating of aluminium paint, and even to a less fraction by the metal spray process. These conclusions have an important application to engineering problems. Thus, for example, the useful radiant heat reaching the centre of a room from radiators round the walls is diminished to one-half of its proper value by the addition of the customary coating of aluminium paint, *i.e.*, the "efficiency" of the radiator as an emitter of radiant heat is reduced to one-half.

On the other hand, the application of metallic paint to the unlagged portions of hot surfaces, such as the boiler fronts in the stokehole of a battleship, should materially increase the comfort of the stokers, working in confined spaces, since it would diminish to half value the true radiation, which is uninfluenced by any amount of artificial ventilation.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Small Dental Motor.

A dental motor which can be held in the hand is shown in fig. 1. According to the manufacturer of the device, the Shelton Electric Co., of 30, East Forty-second Street, New York, it is the smallest motor designed for commercial purposes ever built. The motor is 1·25 in. in diameter and 1·75 in. long, and weighs only 5·25 oz. It runs at a speed of 15,000 r.p.m., and takes a standard dental chuck, which is driven with a one-fourth reduction in speed. This reduction in speed, it is stated, is accomplished without gears or friction devices

Fig. 1.—Dental Motor Attached to Cord with Rheostat.

The motor operates on either direct or alternating current. The armature is hand-wound with No. 40 wire. Use is made of special ball bearings, $\frac{1}{16}$-in. in diameter, and the air gap between the armature and field is 0·0025 in. The switch is of the plunger type, and is operated by a lever which can be pushed back if necessary by the back of the hand. The lever can be placed in three positions, that nearest to the motor being for reverse operation, the centre position for stop, and the position farthest away from the motor for starting. The shaft of the motor is hollow, and bakelite is utilised as insulation. The motor is enclosed in an air-tight steel case.

For varying the speed of the motor a rheostat is provided, which can be placed on the floor, and can be operated by a foot-lever. In case it is necessary for the dentist to call on his patients, a rheostat similar to that shown at the end of the cord in the figure is employed. This rheostat is operated by hand.

Besides being adaptable for dental work, the motor can also be utilised for engraving, manicuring, chiropody and as a light bone drill for physicians. There is no sparking on the commutator, it is stated, and the motor takes only 12 watts. The following advantages are claimed for the device:—The motor is light in the hand, as there is practically no back drag or buckling of cable; efficient operation is obtained on account of the direct drive; and it is not necessary to place the motor on brackets, which are liable to be in the way. The motor is also well adapted for use by students in dental schools.—*Electrical World.*

Small Electric Lighting Plants.

Messrs. Ward & Goldstone, of Sampson Works, Salford, Manchester, have sent us particulars of their Mercure and Sherborne self-contained electric lighting plants, of which a pamphlet has recently been issued.

The introduction of metal-filament lamps brought into prominence the advantages of electric lighting for country houses and cottages, when a public supply was unavailable, and more

recently the small low-voltage half-watt lamp has added further to the sphere of usefulness of this class of plant.

Thus under present conditions, the ¾-H.P. Sherborne electric lighting set which we illustrate, though only taking up a space of about 30 in. × 18 in. × 2 ft. overall height, will now light 16 30-C.P. 2 5-volt half-watt lamps, which is sufficient for a fairly large building.

The Sherborne and Mercure engines are valveless and simple in construction; the lighting sets regularly supplied are rated at (¾ H.P.) 275 watts, 600 watts, 800 watts, 1,400 watts and 1,700 watts.

In connection with these plants a series of batteries of 13 and 27 cells are listed for the 25 and 50-volt installations. Standard

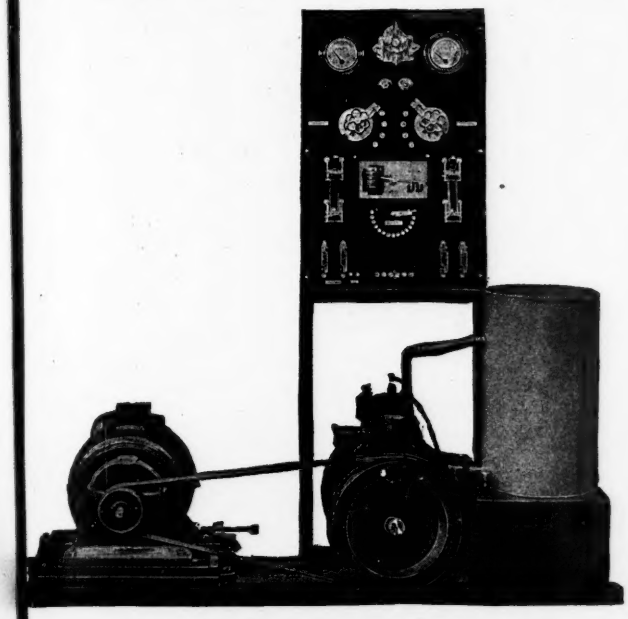


FIG. 2.—SHERBORNE ELECTRIC LIGHTING SET.

switchboards are also supplied, consisting of polished slate panels fitted with voltmeter and ammeter, charge and discharge switch, shunt or series regulator, main switches and fuses, and automatic cut-out or combined cut-in-cut-out.

Messrs. Ward & Goldstone point out that they have supplied many of these plants to the Colonies and abroad, while a number of them are in use in this country, where there are many districts in which they can be adopted with advantage.

"Quead" Electric Fires.

MESSRS. IKIN & EADS, LTD., of 47-57, Marylebone Lane, W., have recently patented and put on the market a new pattern of heating element for electric fires, substantially built up in bar form, which is incorporated in their "Quead" electric fire. The element does not involve any new principle; it consists of a number of specially shaped moulded greyish porcelain pieces assembled on

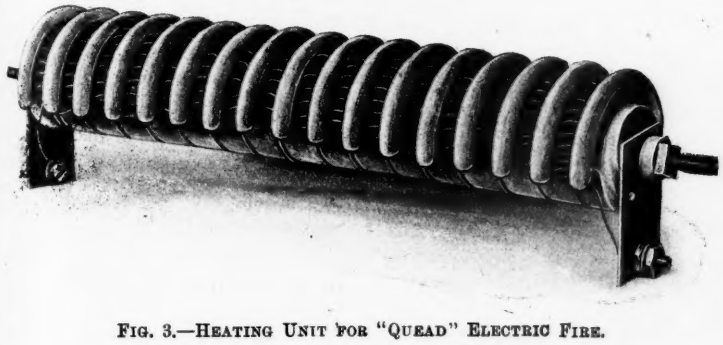


FIG. 3.—HEATING UNIT FOR "QUEAD" ELECTRIC FIRE.

an iron spindle, and clamped between terminal plates by nuts. The porcelain pieces are shaped to form a series of open slots running half round the heating unit, and in these the resistance spiral is placed and firmly held.

The wire is visible, and runs at a red heat, and in turn heats the porcelain supports, giving an excellent effect.

It is claimed for the "Quead" heating unit that it is exceedingly robust, and can be roughly handled, or packed for transit without fear of damage.

An artistic range of cases in cast and sheet iron, copper and brass, bright and black steel, &c., has been designed, and the heaters are mounted singly or in sets, together with the necessary switches, to suit various requirements; we understand that examples of the above fires can be inspected at the firm's premises at any time.

Induction Pipe Heater.

A novel little electric fitting for the motor-car, described in a recent issue of the *Motor*, is an electric primer (catalogued by MESSRS. MESTRE & BLATGE, of 20, Store Street, Tottenham Court Road, W.C.), which consists of a fibre washer with a German silver resistance wire coiled inside it. This is inserted between the carburetter and intake manifold, and is connected through a switch to an accumulator or dry cell. When the engine is difficult to start, the device is switched in, and is said to prove very effective in heating the intake charge. It is also very reasonable in price.

Table Wiring.

The accompanying illustration shows a convenient method of wiring the dining-room table to facilitate the use of electrical cooking devices.

A flush receptacle is put in the centre of the dining-room floor, and three porcelain wall sockets are screwed on the inside edge of the table. Six feet of cord, having a connection plug on

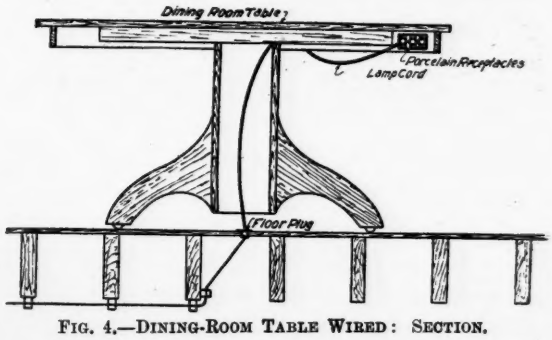


FIG. 4.—DINING-ROOM TABLE WIRED: SECTION.

one end, is run through the centre leg of the table and wired to the back of the porcelain sockets. The heating devices can then be easily plugged into the sockets.

If the table has no centre leg or support, the cord can be brought from the floor and supported to some part of the table on the underside where it will be concealed by the tablecloth.

New Half-Watt Lamps.

Last week we briefly mentioned that the BRITISH THOMSON-HOUSTON CO., LTD., had introduced a number of new sizes of "Mazda" half-watt lamps; we are now enabled to reproduce an illustration of one of these—the 100-watt 200-volt size—with a plan (fig. 6) showing the disposition of the filament in a horizontal plane. It will be noticed that the finely-spiralled flexible filament is

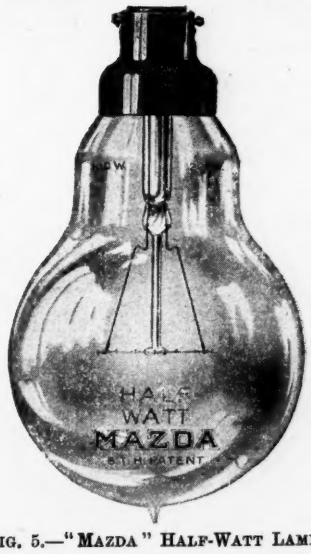


FIG. 5.—"MAZDA" HALF-WATT LAMP.

supported at a great many points, but on the whole the construction is simple. The instruction is given that the lamp must be burned in the vertical position, as illustrated, and that the fittings must be properly ventilated. The light distribution curve of this pattern of lamp will evidently have its maxima above and below the bulb, giving a powerful downward illumination with a suitable reflector. The new sizes are: 25 volts, 15, 30, 60 and 100 watts; 50-60 volts, 30, 60, 100 and 150 watts; 100-130 volts, 60, 100 and 150 watts; 200-255 volts, 100, 150 and 200 watts—all fitted with bayonet caps except the 150 and 200-watt sizes, which have Edison screw caps. The prices of some of the lamps have been reduced.

Similar announcements have come to hand from other tungsten lamp makers. The GENERAL ELECTRIC CO., LTD., draw special attention to the adoption of the registered name, "Atmos type," for their Osram gas-filled lamps. The EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., send us a list of their new "Royal Ediswan" half-watt lamps, on similar lines, and MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., send particulars of their new "Wotan" half-watt lamps. MESSRS. DRAKE & GORHAM, LTD., have issued price lists in practically identical terms.

While we have not yet arrived at the half-watt 16-C.P. lamp for use on 200-volt circuits, it is clear that steady progress is being made in that direction; already consumers on 100-volt circuits can

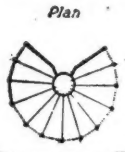


FIG. 6.—DIAGRAM OF FILAMENT.

put up a 60-watt lamp giving nearly eight times as much candle-power as the 60-watt carbon lamp of 10 years ago, and by using a semi-indirect fitting can light a large room with it effectively. That the new lamps will increase the popularity of electric lighting cannot be doubted; and fortunately they come just at a time when, extensions of plant being barred, station engineers will be glad of their assistance in increasing their connections. But the urgent necessity of a fixed charge, plus small running charge, is emphasised by their arrival.

G.E.C. Dust Bellows.

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have put on the market a cheap and efficient dust expeller, which is entirely British made. As shown in fig. 7, it is

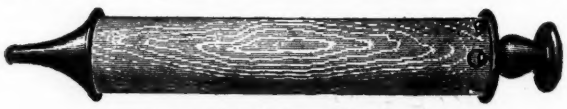


FIG. 7.—G.E.C. DUST BELLOWS.

constructed largely of wood, and is useful for blowing the dust out of electric motors and other appliances without fear of shock, as well as for cleaning typewriters and many other kinds of apparatus.

Keeping Down the Power Demand.

One of the useful "wrinkles" worked out by the men of the Public Service Co. of Northern Illinois to allow rural power users to have several motors and yet pay a low connected-load charge is shown in the accompanying sketch. Here an installation is diagrammatically represented, which consists of a 3-H.P. motor, a 1-H.P. motor and a 5-H.P. motor, yet the greatest connected load that the consumer can put on the line at any one time is 5 H.P. Tracing the circuits through the three single-pole, double-throw

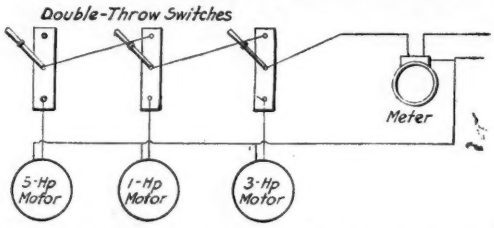


FIG. 8.—INTERLOCKING CIRCUITS TO RESTRICT DEMAND.

switches, it will be seen that it is impossible to connect more than one motor to the line at a time. The same scheme can, of course, be worked out for any number of motors of any size, in each instance the maximum demand of the installation being limited to the rating of the largest machine.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,054. "Magnetos." M. PEDERSEN. June 21st.

9,085. "Electric kettles, urns, and the like." E. A. WELCH. June 21st.

9,097. "Electric hot-water storage installations." E. C. R. MARKS. June 21st. (Sidney le Fevre Varvel, Australia.)

9,101. "Regulating mechanism for controlling the flow of fluids." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 21st.

9,110. "Oil-cooled electric transformers." A. DUCKHAM. June 21st.

9,111. "Systems for producing electrical discharges from a source of energy." R. VARLEY. June 21st. (Convention date, March 21st, 1914, United States.) (Complete.)

9,112. "Systems for producing electrical discharges from a source of energy." R. VARLEY. June 21st. (Convention date, July 1st, 1914, United States.) (Complete.)

9,113. "Telephone transmitters." INTERNATIONAL ELECTRIC CO., LTD., and R. G. LE NOIR. June 21st. (Complete.)

9,120. "Electric meters." W. H. F. MURDOCH. June 22nd.

9,141. "Apparatus utilising electro-magnets or permanent magnets for the protection of ships, harbours, and the like from torpedoes or mines." F. C. BILLING. June 22nd.

9,157. "Electrodes for arc lamps." F. M. LEWIS. June 22nd.

9,158. "Electric cooking." JACKSON ELECTRIC STOVE CO., LTD., R. C. GRIESBACH, H. H. HOLMES, C. H. SMITH, & F. H. WILLIAMS. June 22nd. (Complete.)

9,239. "Portable telegraph and telephone apparatus applicable for signalling apparatus." W. G. UNDERWOOD & UNDERWOOD, LTD. June 23rd.

9,246. "Electric relay." W. R. SYKES INTERLOCKING SIGNAL CO., LTD., and G. H. SYKES. June 23rd. (Complete.)

9,256. "Telegraphy." D. C. CROWE. June 23rd.

9,279. "Targets for X-ray tubes and the like." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States). June 24th.

9,282. "Means for driving dynamo-electric machines." W. LANGDON-DAVIES & A. SOAMES. June 24th.

9,283. "Automatic or semi-automatic telephone systems." RELAY AUTOMATIC TELEPHONE CO., LTD. June 24th. (G. A. Betulander, Sweden.) (Complete.)

9,330. "Lampshade and globe holders for gas and electric lighting." F. W. E. SCHUER. June 25th.

9,336. "Devices for establishing electric connection between conductors." H. G. WOOD. June 25th. (Complete.)

9,345. "Automatic and semi-automatic telephone systems." RELAY AUTOMATIC TELEPHONE CO., LTD., & L. C. BYGRAVE. June 25th.

9,346. "X-ray devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 25th.

9,373. "Electric lampholders and incandescent lamps for the same." W. MAURICE. June 26th.

9,374. "Method of and means for producing undamped or persistent high-frequency electrical oscillations for telegraphic and like purposes." J. R. HALLIWELL. June 26th.

9,386. "Casings for electricity meters." W. HAMILTON & FERRANTI, LTD. June 26th. (Divided application on 24,792/14, December 30th.)

9,396. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. June 26th. (Convention date, June 27th, 1914, United States.) (Complete.)

9,399. "Electrical communication systems." S. TOLKOWSKY. June 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

18,357. METHOD OF AND APPARATUS FOR SEPARATING SUSPENDED PARTICLES FROM GASEOUS BODIES BY MEANS OF HIGH-TENSION ELECTRICITY. E. Möller. August 12th. (August 13th, 1912.)

19,518. CIRCUIT ARRANGEMENTS FOR AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. August 28th. (August 28th, 1912.)

19,732. PROCESS AND APPARATUS FOR ELECTRICALLY SEPARATING SUSPENDED BODIES FROM ELECTRICALLY NON-CONDUCTING, ESPECIALLY GASEOUS, FLUIDS. E. Möller. September 1st. (August 31st, 1912.)

25,391. CONTINUOUS BRAKES AND CONTROLLERS FOR THE SAME. W. R. Smith, Wilson, and Consolidated Brake & Engineering Co. November 6th. (May 6th, 1914.)

1914.

4,237. OPERATION OF LOW-PRESSURE ELECTRICAL INSTALLATIONS FROM HIGH-PRESSURE CIRCUITS. February 18th. (February 19th, 1913.)

5,240. MEANS FOR ATTACHING INSULATORS FOR ELECTRIC WIRES. T. Wittrin. February 28th. (March 1st, 1913.)

5,345. REFLECTOR FOR ARC LAMPS. H. E. Moul (Korting & Mathiesen Akt. Ges.) March 2nd.

5,467. ELECTRIC SWITCH ARRANGEMENT FOR A PLURALITY OF CONDUCTORS, MACHINE OR APPARATUS TO BE CONNECTED WITH THE SAME BUS-BAR AND ADAPTED TO BE SWITCHED IN AND OUT, EMPLOYING A COMMON SAFETY RESISTANCE. Allgemeine Elektricitäts. Ges. March 3rd. (March 4th, 1913.)

6,182. ELECTRIC-CURRENT COLLECTORS. T. B. G. Janssen. March 11th.

6,341. ELECTRICITY METERS. Siemens Schuckertwerke Ges. March 12th. (March 12th, 1913.)

6,520. MEANS FOR ELECTRICALLY OPERATING RAILWAY OR OTHER SIGNALS. Siemens Bros. & Co., and L. de M. G. Ferreira. March 14th.

8,684. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. Electric Utility Co., & R. W. Long. April 6th.

11,097. ELECTRIC BURGLAR ALARM SYSTEMS. J. P. Williams. May 5th.

11,156. CONNECTING ARRANGEMENTS FOR ELECTRIC CIRCUITS. J. H. Wollis-croft & H. T. Boothroyd, Ltd. May 6th.

12,059. INCANDESCENT ELECTRIC LAMPHOLDERS. W. Adams. May 15th. (November 14th, 1914.)

14,006. CONSTRUCTION OF ELECTRIC CONTACT CONDUCTORS FOR RAILWAY TRACKS AND THE LIKE. J. E. Colas. June 10th. (June 20th, 1913.)

14,022. COOLING OF ELECTRIC PORTABLE DRILLING MACHINES. Siemens Schuckertwerke Ges. June 10th. (June 19th, 1913.)

14,030. ELECTRIC TRANSFORMERS. F. E. Berry. June 10th.

14,043. ARMATURES OF DYNAMO-ELECTRICAL MACHINES AND THE LIKE. W. H. Scott. June 10th

14,044. METHOD OF INSULATING COILS OF FLAT CONDUCTORS FOR ELECTRIC MACHINES. Allgemeine Elektricitäts Ges. June 10th. (June 10th, 1913.)

14,108. CENTRIFUGAL COMPRESSORS. British Thomson-Houston Co. (General Electric Co.). June 11th.

14,415. DYNAMO-ELECTRIC MACHINES. H. H. Jeffcott. June 16th.

14,733. ELECTRIC SWITCHES. P. Dunsire. June 19th.

14,974. CONTROLLING DEVICES FOR ELECTRIC CIRCUITS. M. E. Custer. June 23rd.

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17,797. SOCKET TERMINALS FOR ELECTRIC CONDUCTORS. W. A. Hill (Apparate-Bauanstalt Fischer Ges.). July 28th.

18,276. ELECTRIC FUSES OR CUT-OUTS. A. H. Railing & A. J. D. Krause. August 7th.

20,549. HIGH-VOLTAGE INSULATED CABLE. C. J. Beaver & E. A. Claremont. October 5th.

23,930. SELECTING DEVICES FOR TELEPHONE OR OTHER CIRCUITS. O. Imray (Siemens & Halske Akt. Ges.). December 11th.

24,227. NUMBER INSTRUMENT FOR AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens Bros. & Co. (Siemens & Halske Akt. Ges.). December 17th. (Addition to 14,614/13.)

1915.

8,060. ELECTRO-MAGNETIC LOCKING DEVICES. L. Cadenel. May 31st. (Divided application on 13,715/14. June 5th.)